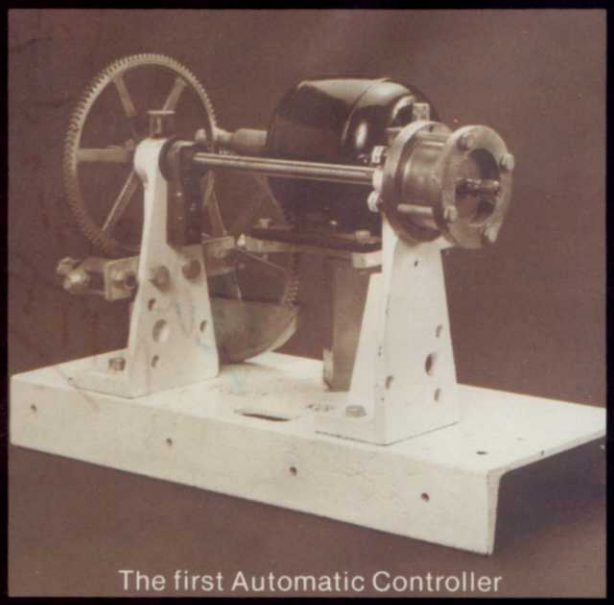
The Business Journal of Vegetation Management June 1978/$1.25

WEEDS TREES & TURF

Mulches and Binding Agents

Weed Control in Small Lakes and Ponds

Trees to Plant on Surface Mined Land



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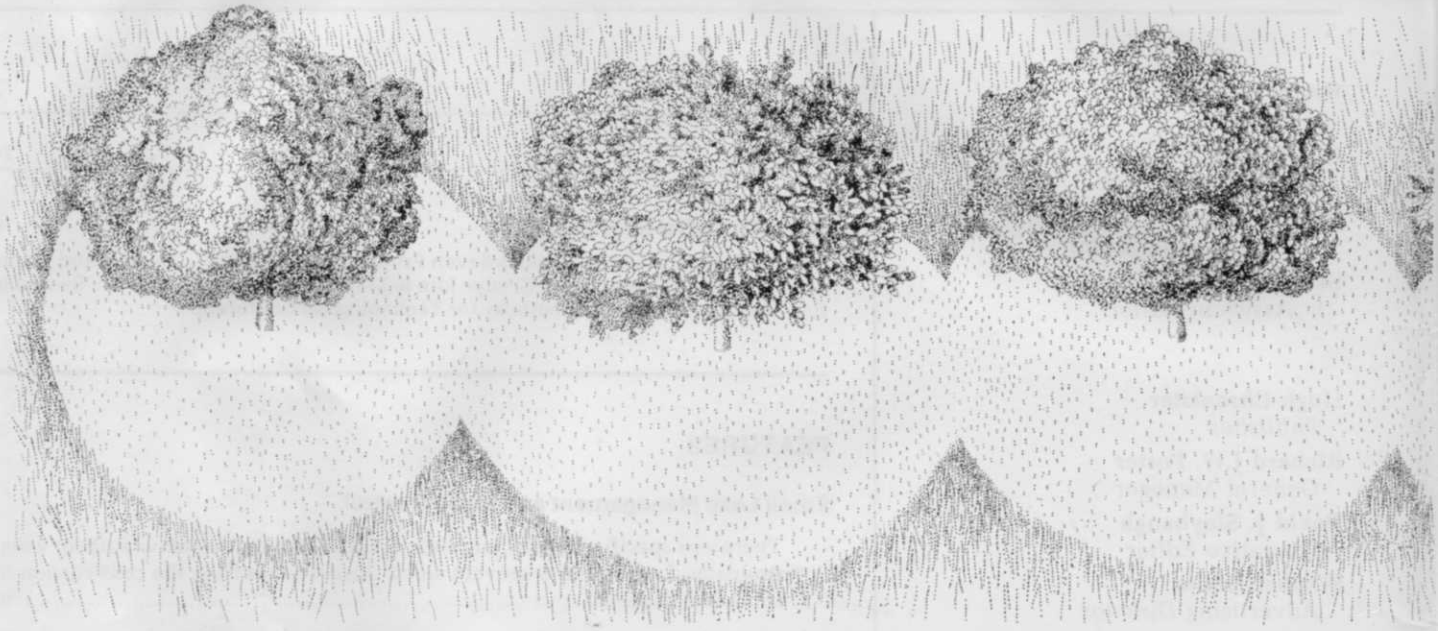
THE NEW GRAV
IT'LL RUN CIRCLES AROU



With its optional 72" mower and 50" wing, the new Gravely GMT 9000 cuts a 9', 11" swath, allowing an operator to mow as many as 33 acres in a standard eight-hour day.

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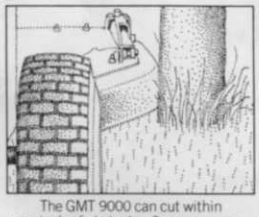


The GMT 9000 can cut within one inch of obstacles. So you save on trimming equipment.

Yet as big and sizeable as the GMT 9000 is, it's also maneuverable enough to cut within an inch of obstacles like fences, shrubs and trees. So you eliminate the need for a lot of costly extra trimming equipment.

Perhaps best of all, besides being able to mow a lot of grass, the new GMT 9000 is designed to keep doing it for a lot of years.

THE STORY OF OUR LIFE.

You see, beneath that impressive rugged exterior, lies an even more impressive interior. Designed to give each and every GMT 9000 a long, lively life.

The exclusive Gravely 8-speed transmission is a good example.

The result of years of testing, it delivers the precise speeds and power you need to do a lot of jobs a lot easier. And a lot better.

You get steady power at low ground speeds to handle the muscle jobs. You also get a choice of seven other speeds for mowing, hauling and rapid transit.

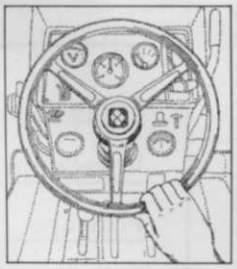
What's more, its precision-cut gears run in an oil bath, for less friction and longer life.

MORE POWER TO YOU.

The engine itself is another excellent example. A water-cooled 4-cycle, 4-cylinder brute, it delivers 26 HP at 3200 RPM. The engine has an oil filter and is pressure lubricated. The crankshaft is spheroid cast iron, counterweighted, running in three replaceable precision bearings.

The cylinder head is aluminum alloy for lighter weight and better heat dissipation.

The wet-type cylinder liners also help to dissipate heat.

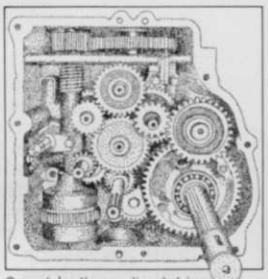


Full-time power steering makes a full day of mowing easy, and practically everything's right before your eyes on the full instrument panel.

The result is an engine that is built to last. And last. And last.

HANDLE WITH EASE.

Yet for all the GMT 9000's brute strength, it handles like a pussycat. The instant forward and reverse, by moving one lever, increases maneuverability, reduces operator fatigue. And you have full-time power steering.



Gravely's all-gear direct drive. A transmission with a lot of teeth in it.

Individual wheel brakes improve steering control. In proper locked position they provide a parking brake for the tractor.

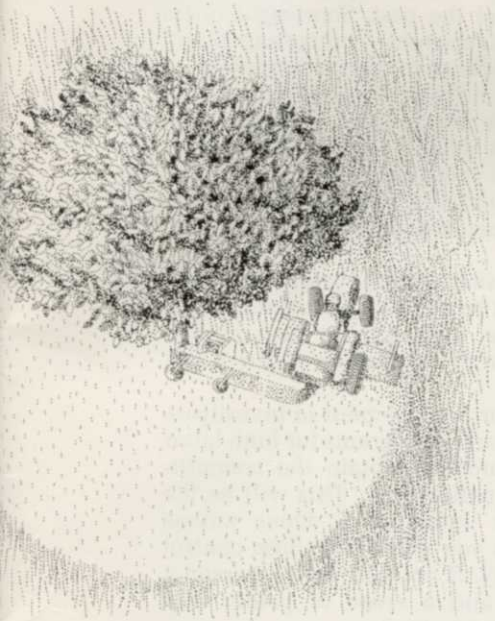
The high-back seat is foam-padded, hydraulically-suspended and fully adjustable for individualized operator comfort.

The full instrument panel shows the operator everything from the water temperature, to hours of operation, at a glance.

THINGS ARE TOUGH ALL OVER.

As you've already seen, every possible part of a Gravely is built extra tough to stand up to year after year of day-in, day-out grounds maintenance. The transmission housing is cast iron.

ELY GMT 9000.
UND THE COMPETITION.



The pivoting front axle is welded steel construction and comes with rugged king-pin bushings. Precision bearings are used at major wear points.

ALL-GEAR DIRECT DRIVE.

The Gravely all-gear direct drive from engine through the transmission and to the PTOs vastly improves power transmission.

And because it's all-gear, it completely eliminates the bothersome belts in the power train which have always been prone to break, slip or wear out.

WITH ALL YOU CAN ATTACH TO A GMT 9000, YOU'RE GOING TO BECOME VERY ATTACHED TO IT.

You've already seen how the 72" mower and 50" wing attachments make the GMT 9000 unsurpassed in mowing efficiency.

What's more, its optional live and independent rear PTO and category 1, 3-point hitch enable it to utilize a number of other attachments as well.

How to keep your tractor from going into hibernation for the winter.

Attachments like plows, cultivators, carts, sweeper and snowblower. As well as equipment like a seeder, sprayer, snow blade, aerator and enclosed cab.

As a result, the GMT 9000 can handle just about every grounds maintenance job imaginable.

In addition to building tractors to last, Gravely wants its attachments to last, too. That's why most Gravely attachments are engineered to be completely compatible.

IT CUTS COSTS NICELY, TOO.

Thanks to its greater performance, durability and versatility over most single purpose mowers, a GMT 9000 should result in a lower total cost ownership in the long run.

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VIEWPOINT

Bruce F. Shank, Editor

Labor. Good people make your company stand out. Bad people make attempts at quality control fruitless.

The quality of labor today is suffering. Managers complain of an absence of ambition, a seemingly unwarranted hostility toward management, and an unwillingness to accept responsibility.

Labor intensive industries are feeling labor pressure more this year than in past years. Minimum wage legislation, labor reform amendments making union organization easier, and unemployment compensation increases have managers on the defensive. Labor, primarily because of unions, is also on the defensive.

How managers react will play a significant role in the future relationship between managers and labor. That is, if they could react and be heard. Unions are making this nearly impossible.

Unions get in the way of the manager's communication with his workers. Incidents with individual workers are too often taken as attacks on the entire work force. Committees designed for the purpose of resolving individual problems overplay their intended role and become lobbying groups for antimanagement sentiment. Likewise, management often overreacts to union requests assuming a built-in compromise area.

Unions are not the entire problem. It goes much deeper.

Managers of the present are paying penalties for bad management of the past. Short-sightedness still pervades many companies. Top management, unwilling to pay middle managers adequately in salaries and fringes, hires less qualified middle managers. Since it is the middle manager who deals primarily with labor, the resulting poor managers often cause labor unrest.

The middle manager who is good often sees his path to upper management based upon an anti-labor stance.

The profit line of short-sighted companies may be higher in the short term, but will not stay there if labor and middle management assume the qualities mentioned at the beginning of this Viewpoint.

Now is the time for management to investigate and institute profit sharing programs for both labor and middle management to obtain the committment necessary for quality work. This will be the best defense against union entry. Once unions organize in your firm you will slowly lose control of salaries and quality. If you can give a person a piece of the action and a sense of pride, why should he or she join a union?

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GREEN INDUSTRY NEWS

RECLAMATION

Kentucky seminar presents latest technology

More than one hundred persons seeking information on mined land reclamation technology gathered at the Madisonville Community College in Madisonville, Kentucky for a field trip and seminar in May. Delegates traveled from Illinois, Ohio, Kentucky and Tennessee, for the two-day educational meeting. Hosted by the College of Engineering of the University of Kentucky and Madisonville Community College, the entourage heard speakers from the U.S. Forest Service, Madisonville Community College, University of Kentucky, AMAX Coal Company, and Peabody Coal Company.

The sessions began Thursday, May 11, with the business meeting of the Council for Surface Mining and Reclamation Research in Appalachia. The major concern was revision of that council's by-laws to broaden horizons, yet limit activities to providing information on vital reclamation techniques and research for those involved.

Dr. Richard Barnhisel, associate professor of agronomy at the University of Kentucky, began the educational sessions by explaining the University of Kentucky's role in reclamation research in Western Kentucky. It includes: land preparation techniques, "ripping" versus smooth grading; the effects of lime and phosphorus on orphaned mined lands; and wood fiber with straw as mulch.

Dr. John Sencindiver, a soil scientist with the Forest Service, showed slides of various mulching experiments he has undertaken and explained the results. He is also concerned with analyzing the benefits of various organic soil amendments for mine reclamation.

Dr. Sencindiver's research has shown that lime and fertilizer, applied on an acid spoil, along with a mulch, will increase vegetative cover.

Mike Ellis, senior reclamation engineer with AMAX Coal Company, talked about using fly ash and sewage sludge in Western Kentucky and Southern Indiana. In one experiment, fly ash was applied to four one-acre plots at a rate of 300 tons per acre. Four different fertilizer rates were used, along with two different seeding rates. Problems immediately cropped up, beginning with incorporation of such a large amount of applied material. The mixture was not homogenous, according to Ellis, and the color was so dark that he felt perhaps enough heat accumulated to damage the emerging seedlings. He also found that the cost of the fly ash far outweighed the advantages and the project was finally dropped.

James Powell, reclamation supervisor-vegetation specialist with the Kentucky division of Peabody Coal Company discussed the research deficiencies of soil reconstruction in land reclamation. Arising out of the new federal regulations and subsequent adoption by states, and mainly in areas classified by the soil conservation service and in the federal register as prime farmland, soil reconstruction presents a dilemma for anyone attempting reclamation. Physical properties, including structure, aggregation, pore space, and bulk density, are going to be affected, probably adversely, during the initial stages of soil reconstruction, Powell said. Compaction will also be a problem, as large machinery necessary to move the soil is employed.

Rufus Allen, U.S. Forest Service, presented data on tree survival on reclamation sites. His research is published in this issue.

Dr. Wayne Rosso, reclamation supervisor and water resource specialist for Peabody, spoke about methods to meet the manganese limits of the new federal surface mining act. Total suspended solids can now be no more than 70 and must average 35 milligrams per liter. The maximum manganese allowed is four milligrams per liter and the average cannot exceed two.

Norman K. Breeding, hydrogeologist in reclamation/mining technology at Madisonville Community College described the use of domestic waste as an erosion control technique in reclaiming mined land.

The Office of Surface Mining was represented by Dr. David Maneval, assistant director, who spoke at the banquet. The federal program will be concerned with such things as blasting, certification, permits, insurance, bonding, and state and federal grants. The current 60 employees will be expanded to 800 a year from now, indicating a significant government interest in mined land reclamation.

TURF

Mower manufacturers urge practical standards

In a special product demonstration recently before the Consumer Product Safety Commission, the lawn mower industry once again urged that any standards developed by the commission avoid restrictive design requirements. It also asked that performance requirement be adopted which would allow manufacturers to develop new technological approaches to protecting users of power lawn mowers.

The commission is in its fifth year of developing a mandatory power mower safety standard. It is not known what effect those standards, once set, would have on larger mowers.

David T. McLaughlin, vice president of the Outdoor Power Equipment Institute and chairman of The Toro Co., Minneapolis, presented the commissioners with a suggested "first draft" of performance language.

Landscape Contractor News

Mine sites to receive funds chosen

Seven sites where coal mines, long ago abandoned, now cause potential danger or health hazards to nearby residents have been chosen for reclamation by the U.S. Office of Surface Mining, an agency of the Interior Department. The government estimates that these projects will cost about $5 million and the work will be done by coal operators with heavy equipment to repair underground mines and landscape contractors to reseed the land to make it usable again.

Some projects will require both kinds of reclamation. One site is near a school building used to teach 272 elementary and high school students in Scranton, S.D., where subsidence near old mining tunnels has created caverns easily accessible to the youngsters. Work to fill the subsidence and revegetate will take between 15-18 months.

The projects were announced May 16 and will get final approval sometime between mid-June and mid-August. These projects are just the beginning of an ambitious program to reclaim old mines which could easily total $100 million in its first fiscal year. Contractors interested in bidding on the projects, which are located in seven states, can write the Office of Surface Mining for further information. Letters should be addressed to Paul Reeves, assistant director for abandoned mine lands, U.S. Department of the Interior, Washington, D.C., 20240.

California tax cut may help landscapers

Landscape contractors in California should experience an upturn in business shortly if that state's voters approve a proposed constitutional amendment June 6 that could cut taxes up to $7 billion a year.

The proposal would roll back real estate taxes to 1 percent of the 1975-76 assessed value and would prevent assessments from rising to current market value until the property changed hands. Approval of the proposal, referred to as the Jarvis-Gann amendment, would slash taxes paid by businesses and homeowners.

Such a large cut in taxes would probably have a beneficial effect on landscapers since it's believed much of the money would be used to improve corporate grounds and homeowners lots. "Hopefully they'll take the extra money and reinvest in their own business and improve the local surroundings," said Joe Brazin, executive secretary for the California Landscape and Irrigation Council, a group of landscape contractors engaged primarily in commercial and industrial work in 13 counties of Southern California. The landscapers hire union employees for their projects.

Denver erosion meeting planned

A symposium on erosion control and revegetation, coupled with an exhibition on equipment and supplies and followed by a two-day tour of reclamation/revegetation projects in the Rocky Mountains has been scheduled from August 1-5 at the Marriott Hotel in Denver, Colo.

The symposium will feature technical programs, including speakers from some of the largest firms engaged in reclamation projects.

The event is co-sponsored by the Associated Landscape Contractors of America and the High Altitude Revegetation Association. Information about the symposium is available from ALCA headquarters, 1750 Old Meadow Rd., McLean, Va. 22101.

"The public interest will not be served by the promulgation of requirements that compel industry to adopt one specific design which increases costs without commensurate benefits, eliminates any element of choice, and retards the incentive to develop new and innovative approaches to lawn mower safety," he told the commission.

The commission is proposing a requirement on future mowers that would include a "deadman control" device. This would shut off power completely or disengage the blade from the power source when the user releases the handle. The commission's staff is considering implementing this device through a blade brake/clutch mechanism.

McLaughlin told the commission that testing by his company indicates that blade/clutch devices presently on the market are not reliable.

Alternative designs addressing the blade contact hazard, which accounts for 68 percent of lawn mower injuries, say the commission, were also demonstrated. They include:

— A conventional walk-behind mower equipped with a control on the handle which requires continuous activation by the operator in order for the unit to run. When the operator releases the control, the blade stops. Starting and stopping controls would also be mounted on the handle.

— A conventional walk-behind mower modified to place the height-of-cut adjustment control in the handle. The unit also includes auxiliary side shields to reduce the possibility of foot contact with the blade.

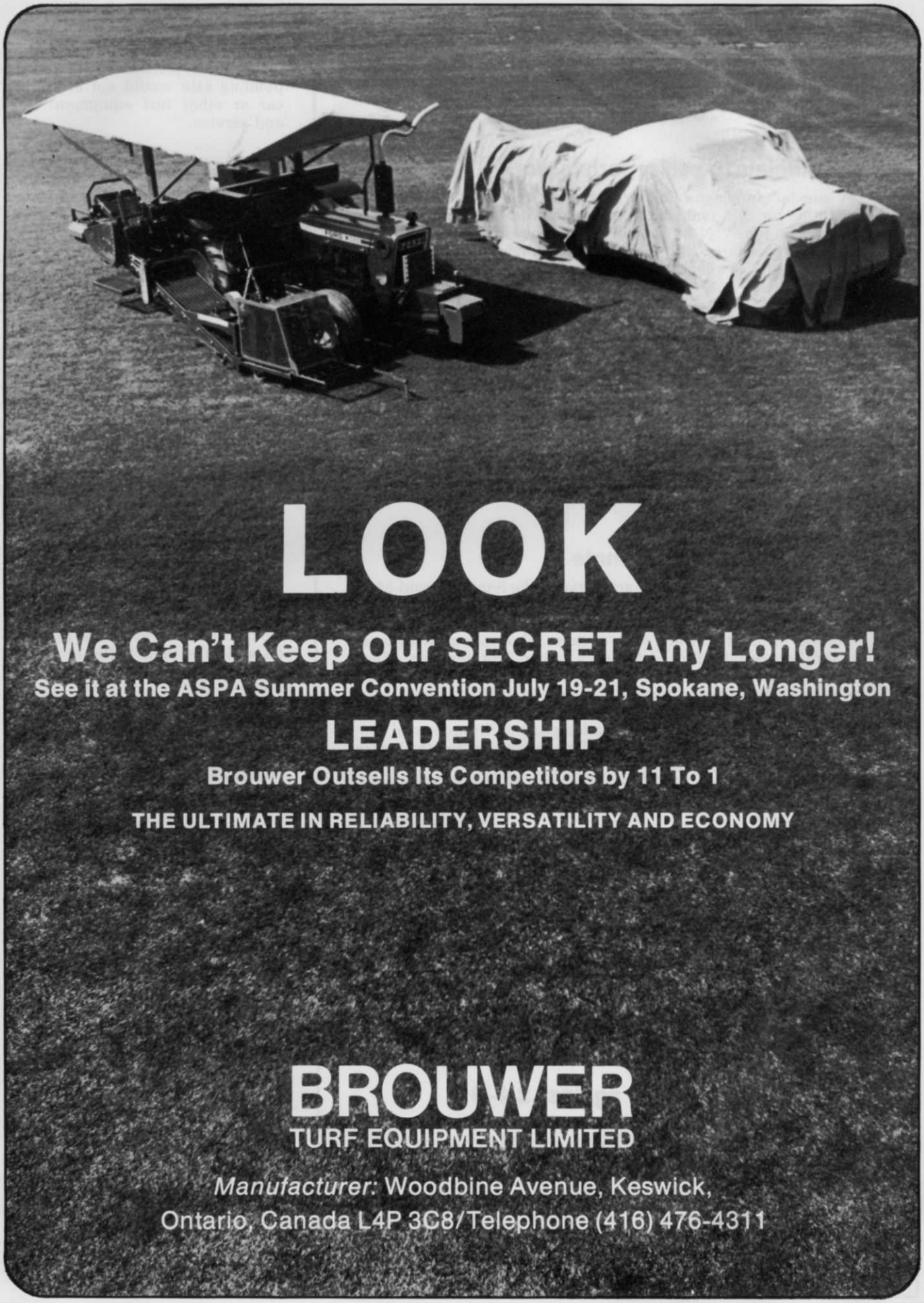
— A conventional walk-behind mower that incorporates a blade interlock with the discharge chute, as well as an automatic latching mechanism to the discharge chute. The latching system prevents the removal of the grass bag unless the latch is unhinged.

EQUIPMENT

Jacobsen and Textron ink sale agreement

Textron, Inc., of Providence, R.I., has signed an agreement "in principle" with Allegheny Ludlum Industries to purchase Jacobsen Manufacturing and the sale should be completed by the end of May, Jacobsen officials have announced.

Allegheny Ludlum sold the firm so it could use that money to help buy Wilkinson Sword, one Jacobsen dealer said.



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GOVERNMENT UPDATE

EPA officials to see arborists work

A special demonstration, arranged by the National Arborist Association for EPA enforcement officials, will take place in Rockville, Md., on June 7. NAA Executive Secretary Bob Felix said other industries have performed such demonstrations to eliminate any misunderstandings about the application of potentially toxic materials by professionals.

Environmentalists focus on cities

Barbara Blum, deputy administrator of EPA, has challenged the environmental movement to focus on the nation's cities. Speaking to the Sierra Club in Berkeley, Ca., in May, Blum said, "It is the urban environment and urban people who are our most endangered species." Blum recommended the creation of 100,000 new environmentally-related jobs to work on sewage, air pollution, and other city projects. What effect this could have on city landscaping projects and minority business project awards is yet undetermined.

Labor act now up to Senate

Debate on the labor reform act began in the Senate in mid-May, and its effect on the industry at that time was mixed; the bill retained an exemption for agricultural employers, meaning that employees of plant growers, such as those who work growing trees and shrubs, are not allowed to join a union. The negative effect, however, was a fear that other businessmen, such as landscapers, would be much more vulnerable to union-organizing efforts if the bill passes.

Senators opposing the bill were attempting to filibuster and prevent a floor vote when debate began. The bill has passed the House of Representatives, 257-163.

The major concern of industry officials is that, if the bill passes, employers with just a few employees will be the targets of organized labor.

"They (organized labor) are interested in organizing the 'Mom and Pop' shops," said Bob Lederer, executive vice president for the American Association of Nurserymen. Lederer backs up his contention by saying that more than 2,000 union elections in 1976 involved firms with less than 10 employees.

The proposed revisions in the law require employers to hold union elections 15 days after the employees ask for it. Currently, there is no time limit. If the employer fails, the National Labor Relations Board would hold the election.

The proposals call for back pay if a worker is punished for union activities and penalties for employers who violate the orders of the court or labor relations board.

Two maybes, one yes against 2,4-D

EPA officials have indicated that there is little doubt that fetotoxicity is a valid trigger for a RPAR against 2,4-D. Teratogenicity and carcinogenicity are "definite maybes". Conflicting reviews of a study, "Chronic Toxicity of 2,4-D in Rats and Dogs", leave some doubt as to carcinogenicity. The EPA's Carcinogen Assessment Group (CAG) has not reviewed the study, but a consultant has and indicates some positive evidence. The National Cancer Institute found the study did not present convincing evidence.

Roy Beattie, public relations director for Jacobsen, said the impending sale would not effect golf car or other turf equipment sales and service.

TURF

Still no pact on seed burning

No decision has yet been announced on the amount of land that grass seed growers in Oregon will be allowed to burn this year for their 1979 crop.

The U.S. Environmental Protection Agency's regional office in Seattle is trying to determine if the growers can use up to 180,000 acres, the amount they have used in previous years. Environmental groups have opposed that figure, saying particulates from the burning fields create health hazards in Eugene and Springfield and violate the federal government's Clean Air Act.

Dave Nelson, executive secretary for the Oregon Seed Council, has predicted that the quality and quantity of seed for next year will decrease if strict limits are imposed. He has said, however, that the council will take their battle to court if the EPA's decision does not meet their needs.

LAWN CARE

Manufacturers invited to Chicago by group

More than 2,000 lawn and garden manufacturers have been invited to an introductory meeting of the newly-formed Lawn and Garden Manufacturers Association on June 19 and 20 at the Hyatt Regency O'Hare Hotel in Chicago.

A director's reception will be held at 6:30 p.m. June 19. The following day, speakers will give an industry perspective of the association, hear a trade press representative, and talk about the definition and scope of the industry. A three-year plan to develop the association and other long-range goals will be discussed by Sanford J. Hill, the association's executive director.

Some charter members of the new group are Nursery Specialty Products, Seaboard Seed Co., Hesston Manufacturing, Melnor Industries and Plant Marvel.

Association headquarters is at at 111 E. Wacker Dr., Chicago, Ill. 60601. The phone number is 312/644-6610.

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PEOPLE

Thomas C. Atkins was presented the Pennsylvania Nurserymen's Association Nurseryman of the Year Award for 1977 at the PNA Annual Banquet held in conjunction with the 1978 Pennsylvania Nurserymen's and Allied Industry Conference at Pennsylvania State University. The award is presented to the individual who has, through his accomplishments, achieved great strides in advancing the nursery industry in Pennsylvania.

Atkins is currently president of Erb Brothers, a wholesale nursery and landscape firm in Lancaster. He is also serving as chairman of the PNA Research Fund and was co-chairman of the aforementioned conference. He is a registered landscape architect.

Wayne J. Watkins has been appointed sales representative for Rancho Verde Turf Farms. Watkins attended California State Polytechnic University where he studied ornamental horticulture with emphasis on turfgrass management. He also was the recipient of the Southern California Golf Course Superintendent Scholarship for 1977.

David J. Hayes has joined the staff of Great Western Seed Company at their headquarters in Albany, Oregon. Hayes' new capacity will include production, marketing, and new product development, with special emphasis on expanding the company's existing position in the forage seed markets. He had been working as an agronomic consultant throughout the Willamette Valley. Great Western Seed is a wholly-owned subsidiary of Lofts Pedigreed Seed Company of Boundbrook, New Jersey.

William D. Ruckelshaus is the featured speaker at the opening of the Pacific Horticultural Trade Show scheduled for the Anaheim Convention Center in California, September 20-22. Ruckelshaus has served as Federal Administrator of EPA, acting director of the FBI, and deputy attorney general of the United States. He is currently senior vice president of the Weyerhaeuser Company based in Seattle.

Cuyahoga County presiding probate judge Francis J. Talty has announced the appointment of **Eleanore B. Kapel** to the Cleveland (Ohio) Metroparks System Board of Park Commissioners. Kapel, the wife of northeastern Ohio builder and developer Milan S. Kapel, is actively engaged in the management and operation of Kapel Management which has its headquarters in suburban Euclid, Ohio. She serves as an elected officer and director of several Kapel corporations in Ohio that are involved in real estate, recreation and lodging.

David J. Hayes

Eleanore B. Kapel

Robby D. Layton

William D. Ruckelshaus

"The appointment of Eleanore B. Kapel to the Metropolitan Park Board is the most recent extension of a long line of services to worthy private and public causes that have characterized her and her family," Judge Talty said in announcing Mrs. Kapel's appointment.

Among the enterprises of Milan S. Kapel is the Berkshire Hills Country Club in Chesterland, Ohio. Because of this personal involvement and activity in golfing, tennis, horseback riding and other outdoor recreation, Mrs. Kapel's prime interest, no doubt, will be the operation and improvement of the Metropark system's six championship and excellent golf courses, plus the nearly 20,000 acres of prime recreational facilities provided by the Parks system in a wide, three-county area.

The Weather-matic Division of Telsco Industries has awarded their annual scholarship to **Robby D. Layton.** The $500 stipend is awarded annually to a park administration major at Texas Tech's School of Horticulture. Layton was chosen because of his excellent scholastic record. He is also active in the student chapter of the American Society of Landscape Architects and has worked summers with park departments in Austin, Texas and Boulder, Colorado.

Deputy Administrator **Karl S. Bowers** has been named acting administrator of the Federal Highway Administration. He took over the new post following the May 1 resignation of Administrator William M. Cox, who is returning to his home state of Kentucky.

A native of Estill, S.C., Bowers joined the Federal Highway Administration as deputy administrator a year ago after having served three years as the first chairman emeritus (1976) and state highway commissioner with the South Carolina State Highway and Public Transportation Commission. He is a captain in the Air National Guard, and a former judge of Magistrate's Court of Hampton County, S.C.

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MANAGING AQUATIC PLANTS IN SMALL LAKES AND PONDS

Small lakes and ponds make attractive additions to parks, golf courses, commercial landscapes, and private estates. However, it is the role of nature to fill in a body of water with time. Proper maintenance and construction can slow down the process.

Natural lakes through siltation become shallower and thus better growing sites for aquatic weeds. Fertilization of watershed areas for whatever reason encourages growth of vegetation in lakes and ponds. Seepage from sewage treatment systems serves to feed aquatic vegetation. Or perhaps, man has simply entered an area where aquatic vegetation was already established and he wants to eliminate it from his property.

Whatever the cause, any aquatic weed problem cannot be solved without investigation of all the reasons why a small lake or pond has an overabundance of weeds.

Construction

More than seven million acres of lakes have been constructed on U.S. farms alone. Most of these were constructed under U.S. Department of Agriculture Soil Conservation guidelines. Owners of privately constructed lakes may not have had the benefit of knowledge available to the farmers.

The following points should be considered when building a small lake or altering an existing lake:

—depths less than three ft. should be avoided. Eight to ten ft. is satisfactory for a small lake.

—for each acre of lake surface there should be approximately 15 acres of watershed if the lake is not stream-fed.

—lakes much smaller than one acre do not provide good natural conditions for fish.

—a spillway should be built to control overflow during heavy rains. Lakes with more than 20 acres of watershed per acre of lake surface should have a cement or stone spillway.

—the lake should not be surrounded by tall trees which shade the water surface. Trees should not be planted close to the shore since roots may encourage erosion.

—measures should be taken to prevent wave erosion for lakes in windy locations.

—sand should not be used heavily for lake beaches since it will quickly drift to the bottom causing depth problems.

—loose soil should be avoided in the watershed area to avoid rapid siltation. Siltation should not exceed one percent of the original depth of the lake in one year.

—if there are a number of lakes fed from one stream, it is preferable to branch each lake off the stream, rather than to have one lake feeding into another.

—good air circulation above the lake is needed to mix upper and lower water levels if the lake is not stream-fed.

—aquatic vegetation produces oxygen during photosynthesis and is therefore necessary for good fish production. It also serves to stabilize bottom sediment.

—the lake bottom should be watertight to the degree that serious drops in water level are not experienced in dry weather. Periodic checks for damage by burrowing animals is advisable.

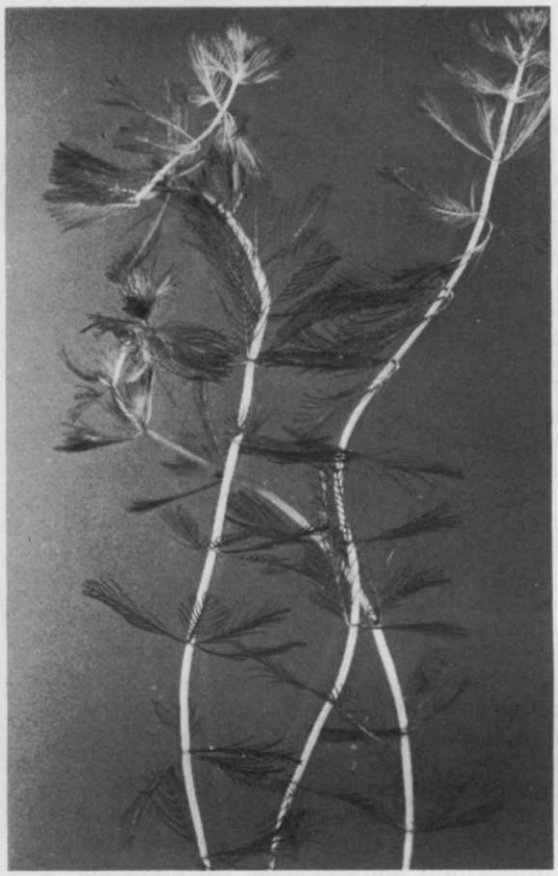
Oxygen content is a crucial factor in lake management. Water holds less dissolved oxygen as it gets warmer. Spring water, although cold, does not carry much oxygen since it has not been exposed to the air. The oxygen content in a lake drops in the summer, especially at lower depths.

A phenomenon called stratification also can occur in the summer. Stratification is the separation of the water into definite layers caused by differences in density as a result of temperature differences. The warmer, less dense, surface layer does not mix with the colder and denser lower layers. Consequently, oxygen does not reach the lower depths of the lake.

Oxygen depletion can also be caused by decay (oxidation) of organic matter in the water. Sewage or organic effluent from livestock can cause severe reduction in oxygen content of the water. Also, lakes near swamps may suffer from an excess of organic matter.

Fish, cold-blooded animals, experience increased respiration as the temperature of the water rises. Consequently, fish use up more oxygen in warmer water. If fish begin to swim at the surface of the lake a serious oxygen problem exists.

Winter presents oxygen problems as well. A thick, snow-covered layer of ice over a lake not



Infestations of aquatic weeds can cause serious drops in land value (far left). Specimen of the submersed watermilfoil (left). The white amur is an exotic species of carp which has great promise for small lake weed control.

only seals out air from the water, but shades the plants under the ice and stops their photosynthesis and oxygen production.

Bubblers and other devises to keep the water layers mixed are available. They can reduce the chance of stratification in the summer and prevent total ice coverage in the winter. Kembro, Inc. makes such a unit.

A small lake should have a natural balance insured by proper maintenance and construction. If it gets out of balance, then the need for a variety of methods to achieve control over aquatic vegetation is evident.

Types of Aquatic Vegetation

Four types of aquatic vegetation are of primary concern in weed control; algae, submergent weeds, emergent weeds, and floating weeds.

Algae are small plant organisms that, when abundant, or in bloom, create an unsightly, smelly, and damaging problem. Algae can clog water filters, irrigation systems, and other machinery. Algal blooms can shade out submerged plants or deplete oxygen dangerously from nighttime respiration. Massive kill-off of other aquatic vegetation can create tremendous amounts of decaying material in a body of water and rob it of its oxygen content. Certain forms of algae are toxic to animals and serve to transmit fish diseases and parasitic infections.

Submergent weeds are rooted in the lake bottom and are totally under water.

Emergent weeds grow in shallow areas with stems and leaves usually out of water.

Floating weeds are either free-floating or bottom-rooted plants which have leaves that float on the water's surface.

Overabundance of any of these plants can interfere with the recreational uses of a lake, speed up the rate of siltation, clog irrigation and drainage systems, cause unpleasant odors, impart a bad taste to the water, crowd out wildlife, and reduce the value of property the lake is on.

Control Measures

Prevention is the first method of aquatic weed control. Regular observation and maintenance of the lake is as critical as any other form of vegetation management. A healthy balance of the aquatic environment should reduce the need for artificial control measures, except for swampy areas where man has entered.

When the lake environment gets out of balance, effective mechanical, biological and chemical means to control weeds are available. Each has particular advantages and disadvantages. In the case of small lakes and ponds, control techniques designed primarily for large lakes are not practical. Attention should be paid not to create a large amount of dead and decaying vegetation in the lake at any one time.

Chemical control of algae is most practical. Application rates should be closely figured and adhered to to avoid any danger to fish. Copper-based compounds, especially in pelleted form, are very useful and are available from a number of manufacturers: 3M Co., Great Lakes Biochemical

Submersed Weeds

Pondweed
Hydrilla
Buttercup
Cabomba
Coontail
Watermilfoil
Slender naiad
American Elodea
Bladderwort

Emergent Weeds

Arrowhead
Bullrush
Cattails
Water primrose
Alligator Weed
Water willow
Smartweed

Floating Weeds

Duckweed
Water Pennywort
Water Lily
Water Lettuce
Salvinia
Water Hyacinth

Hydrilla

Co., Phelps Dodge Refining Corp., Applied Biochemists Inc., and Thompson-Hayward Chemical Co. (See list for addresses.)

Other chemicals for algae control are Aquazine from Ciba Giegy Corp., Diquat from Ortho Div. of Chevron Chemical Co., and Aquathol K from the Agchem Div. of Pennwalt.

Higher aquatic plants are hardier than algae and control is consequently more difficult. The first alternative is to cut and remove them mechanically. This could be done by hand for small areas. Larger jobs may require harvesters that cut swaths of weeds from pontoon-like platforms. Aquamarine Corp., and Air-Lec Industries, Inc. manufacture such devices. Harvested weeds should be removed from the lake and disposed of away from the watershed area. Dredging, burning, and lowering the water level for winter are a few other methods of mechanical control.

Although a number of biological control methods have been tried, the white amur, a species of carp imported from China appears to have the most promise for small lake weed control. The fish is outlawed in most states at the present time, but research by Sutton at the University of Florida may help legalize the fish in more states.

Sea-Ranch Inc. produces white amur commercially. The fish are legal in the states of Arkansas, Florida, Mississippi, and Alabama. The amur con-

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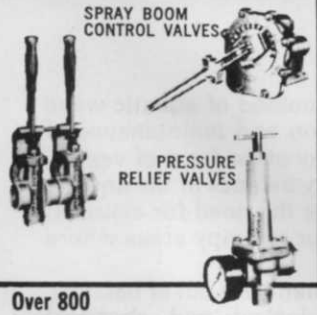

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There are five different Weed Eater gasoline trimmers. Each armed with a powerful 2-cycle engine. And each is designed with features to complete a variety of grounds maintenance missions. Like the Tap-N-Go line feed on the Model 608. Or the big 4-exit cutting head on the Model 657. Or even the metal blade capabilities on many of the models.

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For a full briefing on Weed Eater gas trimmers, write to: Weed Eater, Inc., P.O. Box 37347, Houston, TX 77036.

THE ULTIMATE WEAPON. COMBAT-PROVEN BY VETERANS.

Pictured left to right: Model 698, Model 608, Model 657, and Model 600. WEED EATER®, Inc., a subsidiary of Emerson Electric Co.

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sumes large amounts of aquatic vegetation and does not reproduce successfully in the U.S.

Other natural consumers of aquatic vegetation are crayfish, ducks and geese, other types of fish, snails, and insects.

Chemicals for higher aquatic weeds are applied to the lake bottom after the water level has been drawn down, as granules that sink to the lake bottom, as liquid spray onto the surface, or as a foliar spray. Most chemicals require swimming restriction for a period of time after application. Also, if lake water is used for irrigation, there may be restrictions on use for irrigation. If this is the case, treatment should be avoided in the summer when the demand for irrigation water is greatest.

For submerged weeds the following chemicals are available: Aquazine by Ciba Geigy Corp.; Aquathol and Hydrothol by Pennwalt; Diquat by Ortho Div. of Chevron Chemical Co.; Casoron by Thompson-Hayward; Fenac and 2,4-D by Amchem Products, Inc.; and Systems E and L by 3M.

For emergent weeds the following products are available: Diquat; Dalapon by Dow; Casoron; Weedtrine-D by Applied Biochemists Inc.; and 2,4-D products from Amchem.

For floating weeds there is Aquathol and Diquat.

It is extremely important to read the label of any product and to ask for full information about products from dealers.

Dosages are in pounds per acre-foot. Acre feet are derived by multiplying the surface area of the lake in acres by the average depth in feet. The dealer will also help you make these calculations.

Aquatic weed control is not a simple matter. There are many considerations to be made and questions to ask before going ahead with a weed control program. **WTT**

Manufacturers of Aquatic Weed Control Products

Air-Lec Industries, Inc., 3306 Commercial Ave., Madison, Wi. 53714.
Amchem Products Inc., Brookside Ave., Ambler, Pa. 19002
Applied Biochemists, Inc., 5300 W. County Line Rd., Mequon, Wi. 53092
Aquamarine Corp., 225 N. Grand Ave., Waukesha, Wi. 53186
Chevron Chemical Co., Ortho Div., 575 Market St., P.O. Box 3744, San Francisco, Ca. 94105
Ciba Geigy Corp., P.O. Box 11422, Greensboro, NC 27409
Dow Chemical Corp. P.O. Box 1706, Midland, Mi. 48640
Great Lakes Biochemical, 6120 W. Douglas, Milwaukee, Wi. 53218
Kembro, Box 205, Mequon, Wi. 53092
Pennwalt Corp., 1630 E. Shaw Ave., Fresno, Ca. 93710
Sea-Ranch Inc., Rt. 2, Box 604, Sheridan, Ark. 72150
Thompson-Hayward Chemical Co., 5200 Speaker Rd., Kansas City, Ks. 66110
3M Co., 3M Center, St. Paul, Minn. 55101.

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MULCHES AND BINDING AGENTS TO ACHIEVE EROSION CONTROL

by R. E. Blaser, University Distinguished Professor of Agronomy
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Mulches and binding agents are used in two ways: 1) for temporary erosion and dust control during construction; and, 2) for simultaneously controlling erosion while seedlings become established. The best way to control erosion is with a plant cover.

For temporary erosion and dust control in construction projects with mulches, it is best to seed a temporary species such as annual ryegrass that will give a temporary vegetative cover. Such a temporary vegetative cover along with mulch is effective and persists longer than mulch-binder combinations.

The only practical way to control water and wind erosion is to establish a vegetative cover as quickly as possible. Success in achieving this depends on four steps.

1) Proper grading of slopes, cuts, and medians. The slopes should be as shallow as possible. Steep cuts should be stairstep graded. The surfaces, except for sandy soils, should be left in a rough, loosened condition for all slopes.

2) The appropriate lime and fertilizer mixture to stimulate desirable, persistent, long lasting species must be applied. It is usually necessary to apply high rates of phosphorus. Soil tests are very helpful in diagnosing the lime and fertilizer needs.

3) Appropriate varieties and seed mixtures are of paramount importance. The components in seed mixtures depend on the slope environment, the climatic region, the soil and rock characteristics, the subsequent mowing management or lack of mowing management, and the season of seeding.

For example, for steep cuts and fills, we design lime and fertilizer practices and seed mixtures to give a vegetative cover quickly from temporary species by using small amounts of annual ryegrass or cereals. Through a series of stages of changing vegetative covers, annual temporary grasses shift to persistent perennial grasses and, finally, persistent, hardy, perennial legumes such as crownvetch, flat pea, sweet pea, or sericea lespedeza dominate over the grasses. The legumes add variable beauty and are very persistent requiring no fertilization nor mowing management. We have legume stands on very infertile subsoil materials that have persisted on cuts and fills for over 20 years without additional attention.

Mulching is a final important factor that helps obtain vegetative cover quickly. Good mulches moderate the soil temperature and encourage water infiltration — these improve moisture content, germination, and seedling growth. Without mulches, the forceful contacts of raindrops with

Excellent germination and seedling growth (above) on a 1:1½ fill slope with a rough, loose surface mulched with 1,500 lbs./acre of woodfiber. A roughened 1:1½ fill slope (right) after applying 3,000 lbs./acre of straw and overseeded with a slurry of seed, fertilizer, and woodfiber at 700 lbs./acre.

soil breaks down the soil particles causing the pore spaces to become plugged with fine sandy and silty materials, thereby causing water runoff and erosion. Thus, with mulches, most of the water will filtrate into the soil to improve moisture for the seedlings.

We find that straw, hay, wood bark, wood chips, and wood fiber are the best kinds of mulches. Wood bark and wood chips are expensive to use because 35-50 cu. yds. are needed per acre, and these materials are usually not available in adequate amounts. Straw is generally a better mulch than wood fiber, but straw can also be a poor mulch if it bears a lot of cereal grains or weed seeds. Hay is comparable to straw mulch, but hay crops are usually contaminated with weeds and undesirable seeds.

I have noticed many seeding failures in highway corridors and in our experiments where we used hay or straw because the aggressive plants of cereal grains or weed seeds in the straw crowded the slow growing persistent perennial grasses and legumes. Later, when the annual cereal plants or weeds die, the soil erodes because desirable perennial grasses and legumes were shaded out.

Wood fiber applied at 1500 pounds per acre (8-12 percent dry matter) has given very satisfactory results during the favorable seeding seasons. Some paper fibers are 30 percent water and must be at higher rates to compensate for the water. Wood fiber and paper fiber are of similar value if applied at the same dry matter rates.

Because wood fiber has no contaminants, it is important to use a companion fast growing species such as annual ryegrass at 5-10 lbs. of seed per acre. During periods of stress, wood fiber at 1500 lbs./acre alone is inferior to straw applied at 3000-4000 pounds per acre. Straw cannot be used on steep 1:1 slopes — with heavy rains it usually flows down the slope, also it is difficult to hold in place. For steep slopes, wood fiber is the best material as it sticks to the soil and holds seed and fertilizer in place.

There is no one mulch best for all situations. The mulching should be tailored to the site. For example, for a lawn, it is very desirable to use wood fiber to avoid weed seed and cereal grain contamination. The best mulch treatment from the standpoint of prolonged control of erosion and ease of application is a combination of 3000 lbs. of straw overseeded with a slurry of fertilizer, seed, and wood fiber by the hydro method. We found that seeding the slurry mixture of mulch seed and fertilizer after applying the straw is as good as a three-step operation: 1) applying the seed and fertilizer; 2) applying the straw; and, 3) applying the wood fiber. Binding 3000 lbs. of straw with 700 lbs. of wood fiber has been a superb mulching combination. This is superior to any of the many binders or tacking agents. The wood fiber binds the straw together and at the same time to the soil; therefore, during late fall and winter seasons, when it is too cold for germination, the mulch lasts a long time and does not blow off. In experiments, a straw mulch with wood fiber as a binder has lasted during the entire winter season on steep 1:1½ slope sites. Asphalt, according to a few of our experiments, is the only chemical material that binds straw together satisfactorily; however, soil contact is poor, so removal by the wind is common.

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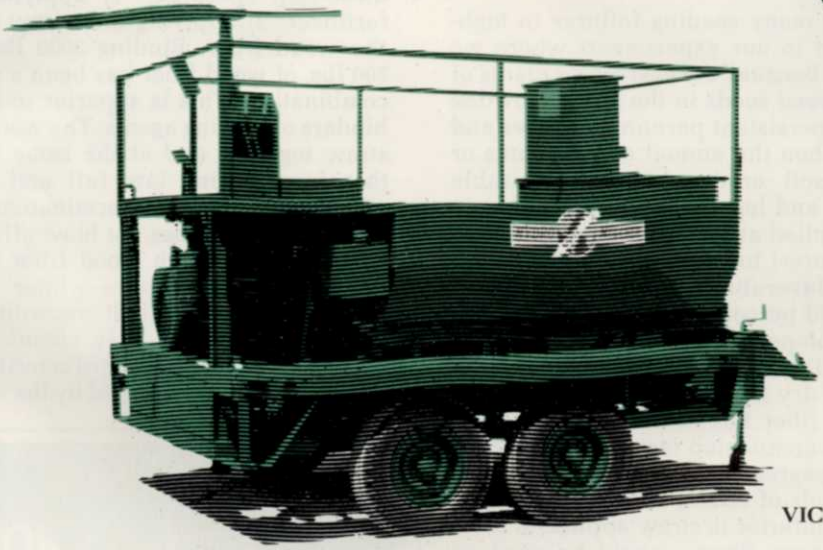

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PROFILE

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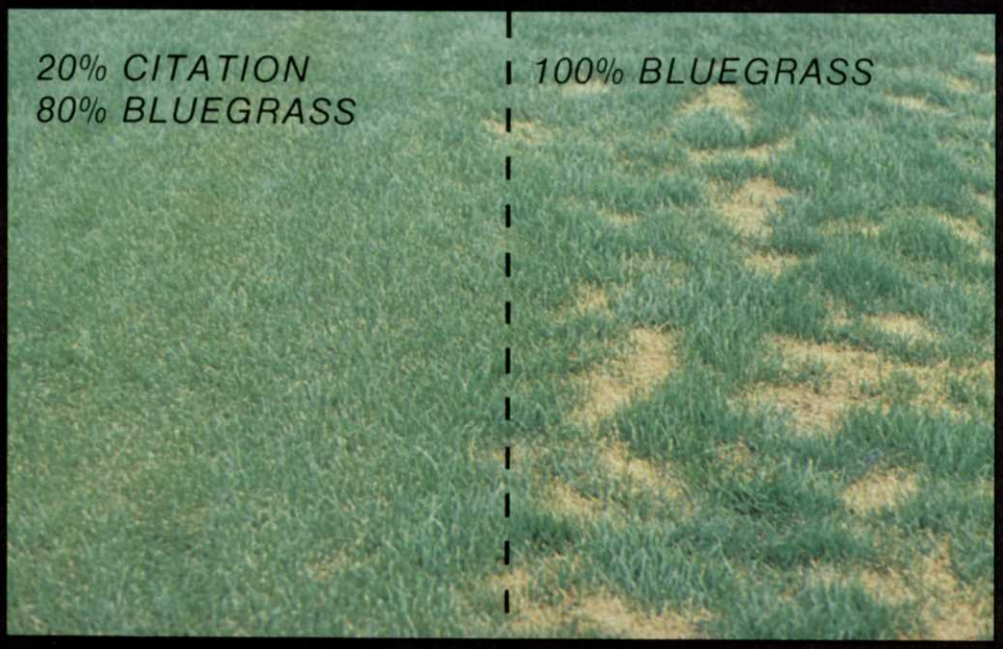

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GROWTH IN LAND RECLAMATION TO TAKE SIGNIFICANT JUMP

Land reclamation/erosion control could be the BIG Green Industry market of the future. Environmental legislation, especially recent surface mining requirements, are expected to increase dollar volume by nearly 30 percent this year. That is more in one year than experienced in the last five years according to survey respondents in the field. The growth is expected primarily in the area of coal and non-highway public works projects.

WEEDS TREES & TURF polled 1,200 erosion control specialists in the International Erosion Control Association and the Associated Landscape Contractors of America. Ten percent participated in the survey. Respondents included landscape contractors and architects, foresters, engineers, highway maintenance officials, utility personnel, and others.

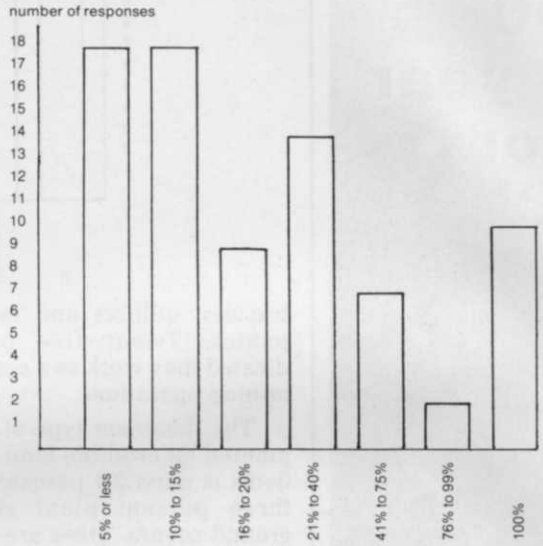
Respondents indicated their primary types of revegetation work at the moment are highway rights-of-way, parks, residential construction sites, industrial construction sites, and utility work sites. Mining site revegetation is performed by only 27 percent of those responding. Reforestation represents only nine percent of the type of revegetation work performed.

The average percentage of gross revenue derived from erosion control was 31 percent with a median response of 20 percent. Ten percent indicated that erosion control makes up 100 percent of gross revenue.

The average volume of erosion control work done in 1977 was $295,529 with a median of $75,000. We asked also for volume in 1973 and predicted volume for 1978 to get a picture of market growth. The average volume for erosion control in 1973 was $277,380 with a median of $50,000. The predicted average volume for 1978 was $381,934 with a median of $150,000.

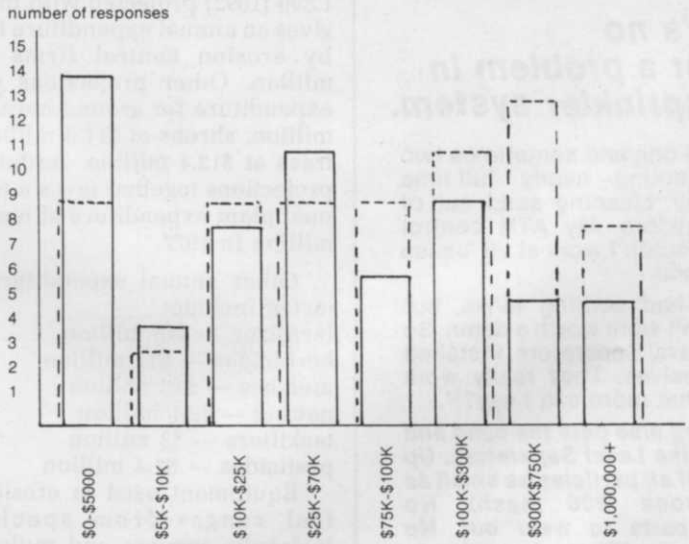
It is evident that a much greater jump in erosion control business is expected this year than has been experienced in the past five years. Projecting the average to 1,200, the base for this survey, the market increased from $333 million in 1973 to $355 million in 1977, an increase of $22 million in five years. In 1978, the market is expected to reach $458 million, a jump of $104 million in one year! Furthermore, when asked about the next five years, respondents predicted an average increase in volume of 117 percent, which would place the market at $760 million in 1982. We repeat, these market figures are projected from the average volume of erosion control work done by 1,200 firms. Growth in the number of firms, which is very likely in a healthy market, may increase these figures significantly.

Percentage of Gross Revenue Derived from Revegetation, Erosion Control, or Land Reclamation



Distribution of Dollar Volume in Revegetation: 1973-1977.

Distribution of the Dollar Volume of Revegetation Work done in 1973 ———
Distribution of the Dollar Volume of Revegetation Work done in 1977 - - - - -



Surface mine revegetation alone will grow at a fantastic pace with the help of funds received from taxes on mined coal and distributed to states for reclamation projects. An estimated $70 million will be spent this way in 1978. Forty percent expect to benefit from mining legislation.

Two thirds of the respondents said they serve as a revegetation consultant to some degree. They consult primarily for public agencies, general contractors, landscape con-

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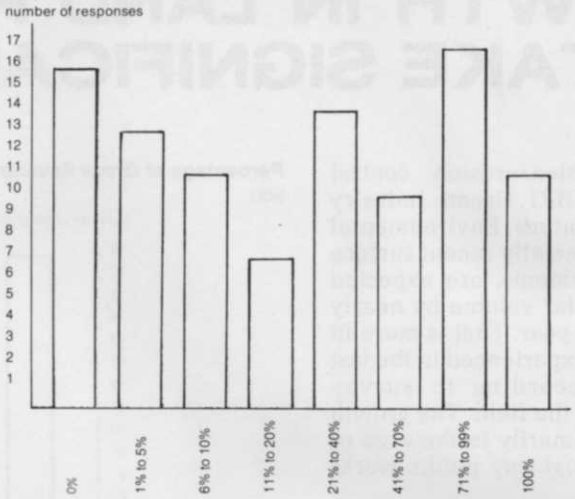
Percentage of revegetation Work That is Hydraulic Seeding



tractors, utilities and mining companies. Twenty-five percent indicated they work as a consultant for mining operations.

The dominant type of vegetation planted on erodible land by respondents is grass (91 percent). Seventy-three percent plant shrubs and ground covers. Trees are planted by 71 percent.

The erosion control firms in this survey spend and average of $24,834 per year on seed. Using 91 percent of 1,200 (1092) projected with the mean gives an annual expenditure for seed by erosion control firms of $27 million. Other projections put the expenditure for ground covers at $5 million, shrubs at $11.6 million, and trees at $12.4 million. Adding these projections together gives a total annual plant expenditure of nearly $44 million in 1977.

Other annual expenditures projected include:
fertilizer — $18 million
herbicides — $12 million
mulches — $13 million
netting — $2.1 million
tackifiers — $2 million
pesticides — $1.4 million

Equipment used in erosion control ranges from specialized hydraulic seeders and mulchers to farm equipment such as seed drills and manure spreaders. The survey was limited to the most common types of equipment.

The following numbers of equipment are projected for 1,200 erosion control firms:
tractors — 5,000
dump trucks — 4,200
tank trucks — 2,250
hydraulic seeders and mulchers — 1,200
fork lift vehicles — 1,050
large earth movers — 604

More than 80 percent of the respondents do hydraulic seeding. Ten percent indicated their business is entirely hydraulic seeding work. The average involvement in hydraulic seeding was 38 percent.

Twenty-one percent do some form of aerial seeding. It makes up an average of 23 percent of the business for these firms.

Finally, we asked if the respondents were familiar with the Surface Mining Control and Reclamation Act of 1977. About half (49 percent) knew of the Act.

A considerably greater amount of research on the reclamation/erosion control market is needed. We hope to have scratched the surface. Since it appears the volume of business in this area is about to jump significantly, research is needed to help manufacturers meet chemical, equipment and supply needs.

Once again, we'd like to stress the projections in this survey are based upon 1,200 names of firms known to be actively involved in erosion control and reclamation in some form. The associations, sources for the survey respondents, probably represent less than the entire market. We encourage anyone considering erosion control or reclamation work to contact regional and national associations to help the market organize for the most efficient growth based on the latest technology and data.

Regional associations can be contacted through state departments of natural resources. At the moment, the International Erosion Control Association, P.O. Box 807, Freedom, Ca. 95019, appears to have the largest membership in the field. The Associated Landscape Contractors of America, 1750 Old Meadow Rd., McClean, Va. 22101, is also active in reclamation technology.

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PEABODY COAL COMPANY: ABIDING BY CHANGING LAWS

The technology of reclaiming surface-mined land has changed greatly in the last 15 years, primarily because laws have mandated what the technology will be and the laws have changed. In 1977, Congress passed the Surface Mining Control and Reclamation Act and the Office of Surface Mining, Reclamation, and Enforcement was created within the U.S. Department of the Interior. Although final regulations are not complete, anticipation of what they will be has created a surge of interest in reclamation of surface-mined land.

One company that has done an admirable job of adjusting to both state and Federal laws is Peabody Coal Co. of St. Louis, Mo. WEEDS TREES & TURF visited Peabody's Broken Aro mine in east centrol Ohio for a look at the changes of the past 15 years and the reaction to upcoming Federal requirements.

Reclamation supervisor Earl Murphy, a forester by training who joined Peabody from the Ohio Park Service in 1973, described the latest revegetation work performed at Broken Aro, one of two surface mines owned by Peabody in Ohio.

The difference between revegetation work performed during three separate periods was striking. Reclamation performed prior to 1965 consisted of many small tree-covered hills, many bodies of water and visible high walls. The dense vegetation and craggy terrain offered protection for wildlife inside.

The next method of reclamation, from 1965 to 1972, consisted of striking the tops of spoil piles and planting trees, 900 per acre, and some grass. The most common tree for reclamation has been the black locust.

The third type of reclamation, performed after 1972, consists of gentle rolling hills of grasses and legumes with networks of drainage ditches leading to silt basins. The company that Peabody leases the land from has asked that it be reconstructed to serve as grazing land.

The three-year permit which Peabody has from the state allows mining of approximately 300 acres per year. The mining procedure goes as follows:

—silt basins are constructed

—top foot of soil is removed and stockpiled

Workers for the Ohio Mining and Reclamation Association prepare to mulch newly seeded area nearby (top). A silt basin (below) is a vital part of mine reclamation and is usually the first step of the reclamation process. Reclaimed soils can absorb limited quantities of rainfall. Therefore, increased runoff must be handled through special ditches and silt basins.

—bulldozers cut benches in the sides of hills.
—workmen drill down from the benches, explosives are placed in the holes, and set off to loosen the soil above the coal
—dragline removes spoils, then coal
—spoils are pushed back into the cut by large, double-width blade bulldozers
—spoils are contoured
—topsoil is replaced
—drainage ditches are cut across hillsides which feed into large ditches which lead to the silt basins
—lime and fertilizer are applied.
—seed is either drilled or hydraulically sprayed
—straw mulch is applied with straw thrower
—crimper goes over straw to bind it to the topsoil

According to Ohio law reclamation efforts must be current. This is defined as within 500 ft. of the digging site. Therefore, reclamation is a continuation of the mining process which is not complete until vegetation is back in place.

Murphy devised a system to provide hay and straw for mulching from the grasses planted during reclamation. Although a number of grasses are used, the most common are Kentucky 31 fescue, sweet clover, lespedeza, orchardgrass, and annual and perennial rye. Applying 2½ tons per acre of straw mulch, Murphy hopes to produce most of the 750 tons of straw needed each year.

Lime and fertilizer are applied each spring and fall to the reclaimed areas. Lime is applied originally at six tons per acre. Extra applications may be made based on soil tests taken regularly. The soil is extremely sandy at Broken Aro and mixed with chunks of sandstone. New laws may require all stones larger than six in. be picked up.

Although Murphy doesn't plant many trees on the latest section of Broken Aro, he uses many trees on Simco Mine, Peabody's other surface mine under his supervision. The types of trees he uses are sweetgum, cottonwood, white pine, black locust, European black alder, and autumn olive. Most of the trees are purchased from state nurseries in vast quantities. Murphy mentioned that river birch showed great promise as a tree in reclaimed areas, but the Indiana nursery stopped producing them. Murphy pointed to healthy patches of grass at the base of nitrogen fixing trees. Some mines are considering harvesting trees on reclaimed land to market as pulpwood.

Perhaps the most unique aspect about reclamation at Broken Aro is that the workers doing the planting are employed by the Ohio Mining and Reclamation Association of Columbus. Peabody is one of approximately 100 members of the association which owns the revegetation equipment, hires the man-

An example of reclamation from 1965 to 1972 in Ohio. Highwalls were topped, trees were planted at 900 per acre, and grass was seeded at 12 lbs./acre mainly by plane. Note the area that failed to accept the vegetation.

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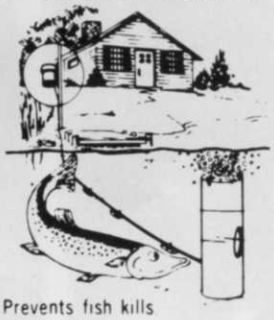

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power, and offers advice. For this service, Peabody pays OMRA an annual dues based upon tonnage of coal produced and an hourly charge for the workers. The revegetation staff of six stays at Broken Aro year-round as does a complete inventory of equipment. Included in the inventory is a Bowie hydraulic seeder, a Finn straw blower, a Brillion seed drill, numerous trucks and tractors.

OMRA is also providing its members with legal assistance on Federal and state reclamation, and is currently lobbying to have air pollution standards adjusted in the state so that Ohio business can burn the high-sulfur coal mined in the state. OMRA works closely with the Ohio Department of Natural Resources which will administer the Federal program when in force. OMRA offers soil and water testing services as well.

Reclamation laws are not perfect, Murphy points out. The requirements discourage removal of coal left in some older mines, since the older reclamation would have to be redone under current standards if part of the older area was reaffected. Prime farm land is the area facing strictest reclamation standards. Complete return of productivity is required within five years of mining. Nevertheless, Murphy remarked, "If you say current, you practically eliminate erosion and productivity problems."

Like many other surface mines, there are occasionally patches where revegetation didn't work. These patches are the greatest challenge of reclamation today. People like Murphy certainly want to understand why such bald areas occur.

Another lingering question is the upward migration of salts from the spoils. Does it occur often? Why? How can it be prevented?

The mystery about revegetation of surface mines should continue until these questions are fully answered. **WTT**

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The business began in 1942, as Southern Mapping and Engineering Company (Southern Seeding Service succeeded this company) based on a need at that time for erosion control on a number of military installations being constructed over the eastern United States. The men who founded the company were agronomists, farmers and engineers with years of experience in the growing of grass and erosion control. Ralph D. Stout, Sr. headed the company at that time. Along with six employees, using antiquated farm equipment, they seeded and grassed airports, army bases, highways and athletic fields. Most of the work was done by hand.

Southern Seeding Service operates office and warehouse facilities in both Greensboro and Raleigh, North Carolina. Most employees are full time with a year round minimum of twenty on the payroll. Southern Seeding Service currently has five superintendents and twenty operators and laborers using the most modern equipment available.

Southern Seeding's management (l to r): General Superintendent Vance Kirkman, Resident Engineer Bob Harding, and President Ralph Stout Jr.

"At the present time, the company owns two hydroseeders, a Toro unit and a Finn unit, four Finn mulch spreaders, three asphalt distributors, eleven tractors and twenty-three trucks. The trucks range in size from pick-ups to 10-wheel truck-tractors. Additionally, Southern Seeding Service operates twelve truck trailers along with tag-along trailers, and all the required miscellaneous equipment such as tillers, rollers, spreaders, seeders and harrows needed to operate a business like ours.

"We're basically satisfied with this equipment. We use primarily Ford Industrial tractors, Chevrolet trucks, along with several GMC's. We do have another company Classic Landscapes, Ltd. in Raleigh, which is in the commercial maintenance business, and in my opinion, the equipment they are trying to operate the business with is just not properly designed nor constructed to withstand the rigors of commercial maintenance work," says Stout.

Last year, Southern Seeding Service spent over $140,000 on equipment maintenance. Certain types of maintenance — painting, minor tune-ups and repairs — are done in-house during the winter. Major engine overhaul, transmission replacement, etc., is normally performed by local dealers.

The company owns all its equipment and purchases $50,000 to $75,000 worth a year.

The size of an erosion control project will vary considerably, says Stout. "Some will go as low as $700, some as high as $300,000. We're primarily involved only in establishing the initial vegetation. However, the contracts with the Department of Transportation, here in North Carolina do include maintenance until the job is accepted. "We do some consultant work primarily for industrial sites where we prepare specifications and submit our proposals on same.

"At the present time, we are in the final stages of completing erosion control work on approximately thirty miles of highway between Kinston, NC and New Bern, NC. We had a total of five contracts in this area, two of which have been completed and accepted. Of the three remaining, Robert Merritt is resident engineer on two of the projects and Bob Harding is resident engineer on the third.

"These three project have represented a particular challenge to our people in that when they were bid, they were scheduled for completion in August 1978, November 1978 and December 1978; however, due to the need to get coastal summer traffic on the new road, we have had to re-schedule our men and equipment to complete our portion of the work by the middle of June. When these projects are completed, it will put the traveling public on a four-lane interstate type highway instead of an antiquated two lane road. We are proud of our performance on these projects.

"We spend over two hundred thousand dollars per year on lime, fertilizer, grass seed and the various mulches we use. We use wood cellulose fiber and straw for mulching. The basic agent we use for holding straw is emulsified asphalt. The price is competitive and it's readily available, plus it does a good job for us. I would like to see a material available that would be priced equal and do as good a job but wouldn't be as dirty and hard to handle. We also use a considerable amount of excelsior matting and "Landglas", fiberglas roving.

"Due to the climate in North Carolina most of our jobs here are seeded and there is not much sodding done. We can usually seed, except in the dead of winter, and get

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reasonable germination. Along the coast, there is some bermudagrass sprigging and beachgrass planting. We've got a job down there, just ready to start, on dune sand that's primarily going to be a sprigging and mulching job.

"We don't see much work coming our way as a result of the Surface Mining Act, mainly because there is not that much mining in the area where we work. We have done some erosion control work for rock quarries; they usually have to take off some overburden, build up a big berm and need to get some erosion control on those areas. We did one job in the mountains for a mica company. They'd had a problem for years, so when we went up and did the work, the newspaper took pictures and wrote it up. We just did our job and Mother Nature took over and made it look good. Sometimes she makes us look bad though.

"The Trade Association that has done the most for us is the Associated Landscape Contractors of America. That's the association for businesses like ours. We also belong to the North Carolina Landscape Contractors Association which really got started as a result of ALCA involvement. Additionally we're national associate members of the Associated General Contractors of America and associate members of the Carolinas Branch of AGC. As far as industry educational programs go, we feel that we find what we need in ALCA's annual meeting and the programs and seminars they sponsor around the country.

"On the one hand, we see business opportunities for us in the next couple of years, however, the Minority Business Enterprise requirements being pushed by the federal government could adversely affect small businesses like ours. Since the majority of our work is subcontract involving federal money participation, general contractors may find themselves in the position of being unable to subcontract erosion control work to us due to having to conform to the quotas being established by the federal government.

One of the greatest things about our country is that people have the opportunity to do the thing they think they can be most successful in but by the same token, I dislike the prospect that the federal government may legislate us out of business by discriminating against us. We have even considered setting up a minority owned business enterprise which would in actuality only be a sham. We are not willing to play that sort of game so, if Southern Seeding Service gets legislated out of business, Uncle Sam is just going to miss a good tax payer.

"The greatest asset of our company is our people. A few years ago, we brought in some younger people who, while they weren't really professionally trained, had the proper attitudes to come in and learn the business. They're our key people in the field right now. Our philosophy is, "You can have all the equipment in the world and you can have all the money to finance it with, but if you haven't got the folks doing the job, forget it, you've got nothing."

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TRENDS IN TREE PLANTING ON MINE RECLAMATION SITES

By Rufus Allen, Research Forester, U.S. Forest Service

The following article is excerpted from a talk given by Mr. Allen at a meeting of the Council for Surface Mining and Reclamation in Appalachia, held in Madisonville, Ky. Mr. Allen joined the staff of Northeast Regional Forest Research Experiment Station in Berea, Ky., in 1961. He is currently conducting tree planting research on reclaimed surface mines in western Kentucky.

It would appear that after 40 years of research, we in the forest service should know what trees to plant on surface mines and how to plant them. If all we want is trees just to say we have trees, the above statement can be assumed to be true. However, if we are thinking in terms of high-value tree species that will yield a high monetary amount in return, then we're still back in the dark ages.

Many sites have been replanted successfully with Virginia and Loblolly pine and several species of hardwood, namely Black Locust. The Loblolly pine grows well in Kentucky but is apparently subject to ice damage and winter burn from the extreme cold that we've had for the last 2 years. Virginia pine is an excellent pulpwood species, but will there be a market for it when it is matured?

And lastly, what are we going to do with the thousands of acres of Black Locust? Most of the disturbed areas in western Kentucky were hardwood sites, as were most of the disturbed areas in the surrounding states. It is natural then to reclaim these areas to their original status. This has been attempted on many areas over the years. Some of these attempts have been notable successes, others failures, and some just mediocre.

Overall, we have had about a 35% survival rate on hardwood plantations since we started planting hardwood trees several years ago. This rate even extends to our newer studies, recently installed. The notable successes in the past continue to encourage us and to give us hope that we can consistently get good results from present and future plants.

What are some of the problems that face us on getting good survival and growth of trees? Well, first and foremost is the fact that mining spoil is not agricultural or silvicultural soil as we know it. I would say that many of our problems arise from this fact.

I'm going to add another category, biological factors. And under this I have the lack of micro and macro organisms. Not only are these items problems in themselves, but their interaction problems are many. In many cases we don't know the answers because we don't even know the questions. Willis Vogle, our range scientist in Berea (Ky.) has found it necessary to fertilize a site in order to get satisfactory grass and legume growth, but we in the forestry picture have found that, most of the time, the application of nitrogen and phosphorus is detrimental to tree survival, if we apply them at the time of planting. There are studies going on; planting with fertilization before the fact, during the fact and after the fact.

Another subject that affects us is the problem of allelopathy, the toxicity or inhibiting factors of one plant on another. This problem is not new in literature, but it is new to us. At the present time there's only one book on the subject in the English language. Not only are these items problems in themselves, their interrelationships compound our problems.

For instance, we know that some seeds are allelopathic in the absence of micro organisms. We also know that the presence of fescue grass inhibits the germination of some pine seeds. We know that crownvetch inhibits new root growth of year old Red Oak seedlings. The allelopathic role is still not completely understood, but some substances have been identified that apparently are inhibiting agents. One of these is in the realm of phenolic compounds. Interestingly, our research geologist in Berea highly suspects the presence of some phenolic compounds in some spoils that he has analyzed. It is noteworthy to add that the difference between allelopathy and competition is difficult to separate scientifically. These factors that we've just talked about form the basis of our tree planting research in western Kentucky.

The first of our recent plantations was established in 1976 with the cooperation of the Pittsburgh and Midway Mining Company. This study and a subsequent study established in 1977 are much the same. Now we have more variables than we had seasons to plant, so we made up. We used Black Walnut, White Ash, Green Ash, Sycamore, Sweet Gum, Cottonwood, White Oak and Yellow Poplar. We wanted to test some of the seedlings that we've had good luck with in the past and some that we've had back luck with in the past. We also wanted to test tree-grass competition at the same time so we used control plots, fertilizer only plots, fertilizer and legumes, and fertilizer with grass. And we also used nurse trees as a nitrogen fixer. We used Black Locust, European Black Olive, and we also used both. We substituted for both in 1977. We used Autumn Olive which is also an excellent nitrogen fixer. And of course we had a control of none. We used hardwood bark mulch, with control trees with no mulch and, of course, trees with mulch.

The 1977 study was installed to check the differences in planting years and the possible consequences of different weather conditions. Following the 1976 planting we had an extremely long dry spell, about 6 weeks. We expected the worst. The spring of 1977 was more nearly normal than that of 1976 and we expected better. But you never get what you expect especially in silviculture.

In our study established in 1976 on the P & M land we used White Ash, 1-0 stock and 2-0 stock. We used 2-0 Black Walnut stock. I've never seen such huge 2-0 stock in all my life. No wonder they wanted to get rid of it; they knew they couldn't

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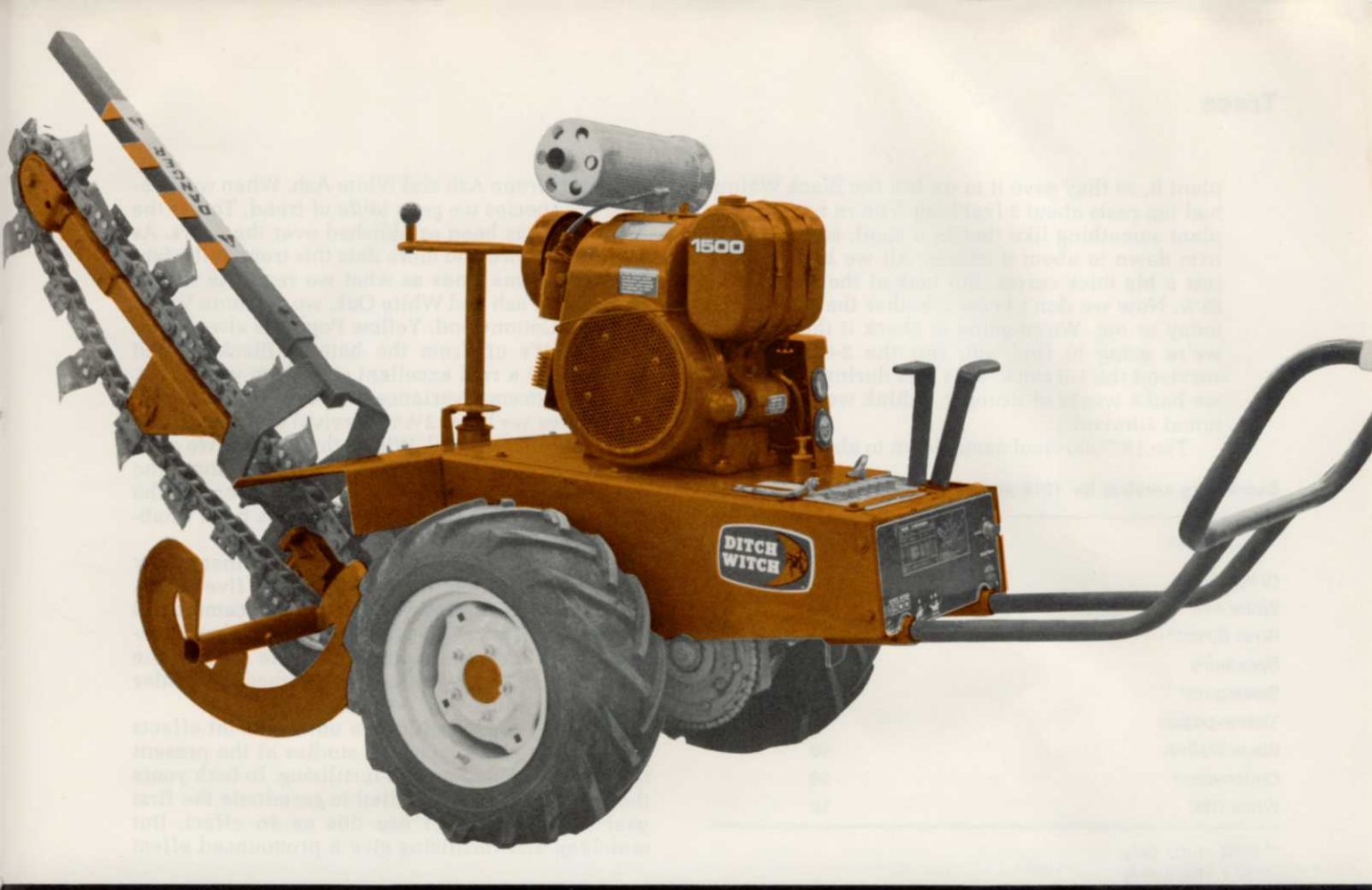

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plant it, so they gave it to us. But the Black Walnut had tap roots about 3 feet long. You're not about to plant something like that in a spoil, so we had to trim down to about 6 inches. All we had left was just a big thick carrot. But look at the survival — 65%. Now we don't know whether that holds true today or not. We're going to check it this fall and we're going to find out. But the 2-0 stock outsurvived the 1-0 stock. This was during a year that we had 6 weeks of drought. I think we had exceptional survival.

The 1977 survival came down to about the same again for Green Ash and White Ash. When we combine the species we get a table of trend. This is the trend that has been established over the years. As we look at more and more data this trend falls right along the same lines as what we read. As we get more green ash and White Oak, we get more White Ash and Cottonwood. Yellow Poplar is always, not last, but it's up from the bottom. Black Walnut seems to be a real excellent species to work with. We get extreme variance in our Black Walnut. Sometimes we'll get 2½% survival and sometimes we'll get 65% survival. Why is this? Again, we can't give an answer because we don't even know the questions yet. As we will note from observing the previous survival count, the trend has been established.

Combining survival for 1976 and 77 begins to show a trend:

Species	Percent Survival
Green Ash	53
White Ash	42
River Birch**	39
Sycamore	20
Sweetgum*	20
Yellow-poplar	17
Black Walnut	16
Cottonwood	16
White Oak	12

**1976 study only
*1977 study only

Recent studies by Willis Vogle and others show that Sycamore dies back after about five years. Some people's studies will show that Sycamore did real good. Most of the time we found that Sycamore died back and would just come back in the same root stock year after year. Either the leader dies or the entire stem dies.

The only meaningful data on treatment effects that we can glean from our studies at the present time are on mulching and fertilizing. In both years the grass and legumes failed to germinate the first year. So we couldn't use this as an effect. But mulching and fertilizing give a pronounced effect

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Effects of mulching on survival:

Species	Percent Survival 1976 Mulched	1976 Unmulched	1977 Mulched	1977 Unmulched
Green Ash	48	44	68	44
White Ash	35	23	62	49
White Ash (2-0)	50	32	—	—
River Birch	42	35	—	—
Sycamore	13	14	30	24
Sweetgum	—	—	26	13
Black Walnut	52	43	8	3
Black Walnut (2-0)	70	60	—	—
White Oak	34	29	24	5
Cottonwood	33	27	6	4
Yellow-poplar	9	7	.4	.2
AVERAGE	38	30	28	18

on survival. In both 1976 and 1977 mulching the trees increased survival. In the 1976 and 1977 studies we mulched alternate trees in every row. Evidently mulching helped retain moisture and reduce micro-site temperatures because survival was increased for most species.

We used about a bushel of mulch for every tree. This is about 4 inches thick and reaches out to about 15 inches from the center of the pile or the seedling itself. In the earlier study of 1976 we had used about half this much mulch and, within a year, it had flattened out and almost deteriorated. We can go back to the ones where we used 4 inches of mulch and it does look substantial, even today.

Fertilization effects on species survival:

Species	Percent Survival 1976 Fertilized	1976 Unfertilized	1977 Fertilized	1977 Unfertilized
Green Ash	38	61	61	64
White Ash	26	46	62	63
Sycamore	14	16	29	35
Sweetgum	—	—	24	30
Black Walnut	43	54	6	13
White Oak	31	44	14	20
Cottonwood	25	38	5	5
Yellow-poplar	6	13	.5	.5
AVERAGE	26	39	50	56

Fertilization

We have found in the past that addition of nitrogen and phosphorous fertilizer has decreased survival. In some studies we have found this decrease to be significant. The decrease in survival, due to

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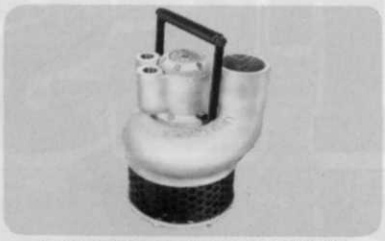

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fertilizer, effects hardwood as well as pine seed. This effect has also been found on whole fields and forest sites as well as surface-mined lands.

Fertilizer rate was 400 pounds of 18-46-0 and 100 pounds of 0-0-60. In an early study on bush lespedeza, the decrease in survival was thought to be from the common phosphate. We found that dicalcium and triple-super phosphates significantly reduced survival. After studying data and survival results from the past several decades, we come to the conclusion that we haven't really increased survival over this period.

We have several thoughts along this line. One thought is that perhaps our planting crews are becoming less efficient. If the crewman is paid by the ceiling, his thoughts are on quantity rather than quality. If he gets paid by the hour and a minimum wage, he thinks he's just doing a job that's not very important. Since our desired end result is good reforestation, tree planting is a very important part of the total picture.

Another thought is of the conditions under which we plant with our present technology, expertise and species adaptation. These are becoming less conducive to survival than they were several decades ago. For instance, studies of 30 years ago showed evidence that survival was greater on ungraded spoil than on spoil compacted by grading machinery. Also, at that time, over-

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For years, fungus disease control has been a source of trouble, frustration and expense. The problem is not the fungicide itself, but the application: how to keep it in place despite torrential rains and irrigation. The problem is wash-off.

That's why the development of Exhalt800 is a milestone of progress in the turf world. Here's the story:

Unlike many sticker-extenders that give little help, Exhalt800 encapsulates every fungicide particle with an armor of protection . . . a sticky, flexible "fabric" that clings to turf and foliage, essentially on contact. Yet it flexes and "breathes" to allow normal plant growth.

Because Exhalt800 keeps much of the fungicide in place, even in extreme weather, it can double or triple the control period. Even if it rains an hour after application, you'll still have effective control (see test chart), with less wash-off and less build-up of residue in soil.

Using Exhalt800, you may save 50% or more because you will need fewer sprays, you will use less fungicide with each, and reduce labor costs proportionately. Meanwhile, you can be confident the disease won't flare out of control. The evidence is clear.

In university field tests using leading fungicides, Exhalt800 added to spray tank at minimum-label recommendations gave control equal to higher recommendations without Exhalt800. With higher Exhalt800 dosages, you can double or triple the control period. Results can vary with the kind of fungicide used.

Exhalt800 costs little because it goes far (mix one pint with each 100 gallons in spray tank). Won't damage turf, trees and ornamentals when used as directed. Easy to use: add to spray tank and agitate. Easy clean-up: rinse equipment with water. If frozen in storage, Exhalt800 won't separate; may be thawed and used.

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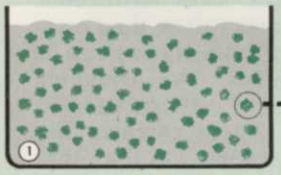
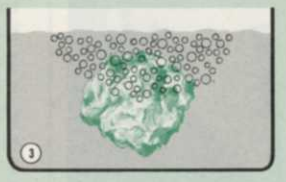
As an efficient manager, can you ignore the overwhelming evidence? See your Gordon distributor for information, prices and technical assistance.

A closer look at Exhalt®800 — the reason it works

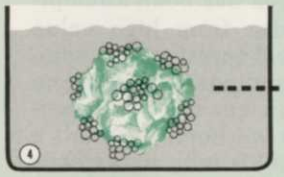


1) Microscopic particles of fungicide are suspended in water in spray tank.

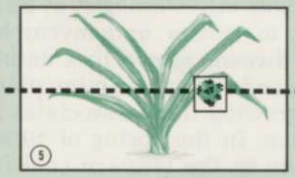
2) One minute fungicide particle, greatly magnified. Countless millions of such particles in water become the spray solution.



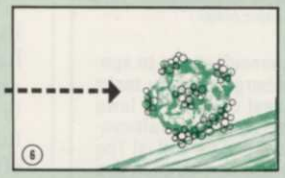
3) Exhalt800 liquid enters spray tank. Hydrophobic (repelled by water), it breaks into a myriad of tiny droplets and attaches to fungicide.



4) Tiny Exhalt800 droplets form a porous, flexible "fabric" that encapsulates each fungicide particle (enlarged to show detail).



5) Turf, when sprayed, becomes coated with millions of fungicide particles, each particle encapsulated within the porous "fabric" of Exhalt800 droplets.



6) Encapsulated fungicide particles on blade of grass (magnified portion). The Exhalt "fabric" around each particle is porous and flexible; it lets plant "breathe", flex and grow, releases fungicide slowly.

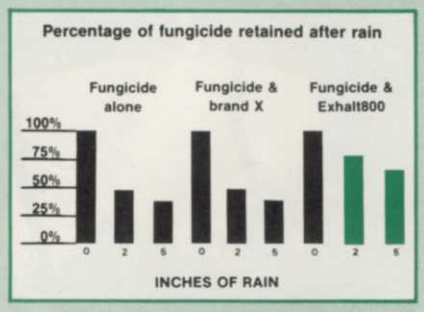


Chart shows how Exhalt800 resisted wash-off in a laboratory test. Spray coatings were applied to glass panels and dried 10 minutes at approximately 70°F. Retention after erosion by rain was measured by solvent stripping the panels and determining the residual fungicide by quantitative ultraviolet spectroscopy.

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burden removed was not as deep as it is now. Maybe our increase in expertise is just keeping pace with the increase in adverse spoil conditions, hence no net increase in seedling survival.

This spring, with the cooperation of AMAX Coal Company's Ayrgem and Pittsburgh and Midway's Colonial mines, we installed a study that's combined the old with the new. We plowed the planting areas with a disc harrow or chiselplow. We did use both the chiselplow and the disc harrow. We used the chisel plow on P & M Colonial Mine and we had to go with the disc harrow on the Ayrgem mine because there was old log grass that clogged the chisel up and lifted it right out of the ground after about 10 feet. We had to go to the disc harrow to get the job done. After we plowed it once, we plowed it again 90 degrees from the first direction. Then we called on our most experienced personnel to plant with planting hoes and a, I'd say relatively new in design, planting bar.

We also used our tractor with an auger operated from the power takeoff to mechanically dig the planting holes. Half of these holes was backfilled with spoil and the remaining half was backfilled with top soil from a forest. As nearly as possible we simulated the loose spoil conditions of yesterday, along with some of the planting methods, technology, and expertise of today. We did have some problems with the auger. We broke one universal joint and we broke one shear pin. What really gave us a problem was that the point on the end of the auger would hit a small rock right dead center. That rock wouldn't move and neither would the point.

We mulched every other row of trees with hardwood bark mulch and we did not fertilize. We used Black Walnut as a starting species because of its potentially high value and the trouble we've had with survival in the past. We also interplanted Autumn Olive as a nitrogen fixture.

In the past few years much work has been done and knowledge gained in successfully inoculating the seedlings with mycorrhiza. Most hardwoods have endomycorrhizal associates rather than ectomycorrhizal. The research of endomycorrhiza is much different, more difficult. The isolation, growth, inoculation, testing and reinoculation of species is time consuming. Ectomycorrhiza has visible and collectible spore forms. On the other hand, most of the endomycorrhiza have no visible or collectible spore forms and is not evident on visible inspection of the roots.

Our microbiologist at Berea has been attempting to isolate endomycorrhiza from high value hardwoods grown in a natural forest in the nursery and on surface mine plantations. At present he is growing these associates in quantity for inoculation. In the spring of 1979 we hope to install a study in the western coal fields with hardwoods inoculated with different endomycorrhizal fungi. Our last study concerns planting methods. We have a hundred extra Black Walnut trees that we can sacrifice each year and study their roots for mycorrhiza and their tops for nutrient growth and the presence of essential nutrients and toxic elements. **WTT**

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ABILITY TO CHANGE, RESEARCH ARE VITAL ACCORDING TO BOARD

Alva P. Burkhalter, Ph.D.

Dr. Burkhalter is chief of the Bureau of Aquatic Plant Research and Control in Tallahassee, a division of the Florida Department of Natural Resources.

Burkhalter received his Ph.D. in plant physiology from Auburn University in 1970. His B.S. in forestry and M.S. in genetics were earned at the University of Georgia.

Burkhalter's latest research explores the use of the white amur for aquatic weed control in landlocked lakes used for irrigation. The exotic fish is banned in many states for fear of its effect on the ecological balance of the aquatic environment. Burkhalter thinks research on the fish will dispel such fears and legalize use of the fish in more states.

Burkhalter is a member of the Weed Science Society of America, the Aquatic Plant Management Society, (APMS), and is a past president of the Florida Chapter of APMS. Hobbies include hunting, fishing, guitar, banjo, golf, and basketball.

Aquatic Plant Management — the science, profession and the problems — is still in the early stages of development. Compared to childhood, it would now be in its rapidly expanding and growing adolescent years.

The science of Aquatic Plant Control has developed as branch or support function of many other major areas. Its earliest function was to assist commercial efforts by controlling plants that caused problems to navigation. From here it has expanded to other areas of concern — Fish and Wildlife, Public Health (Mosquito Control), agricultural irrigation and potable waters.

With the growing population of our nation and the increased emphasis on multiple usage of water, the aquatic plant managers of today must understand the various facets of aquatic plant control and how they differ, while at the same time relate to each other. This is becoming increasingly important because water used today for one purpose may be used tomorrow for another.

Aquatic plant problems are generally directly attributable to man's activities as he progresses. Man's increased mobility and world traveling have led to the introduction of exotic noxious aquatic plants that now plague many of our waterways. His pollution either from industrial, agricultural or domestic waste often provides excessive food stuff for their growth and mans designated usages of waters and conservation practices (navigation, irrigation, etc.) often mean that even the native plants that were heretofore no problem have subsequently become a problem in these types of waters.

Current trends in control necessitate that the aquatic plant manager of today be a "jack of all trades." Early aquatic plant control centers mainly on the use of machines of which similar methods are still used today. The most commonly used method of control at present is chemical, but rapid development is taking place in the area of biological control. Therefore, the managers of today must be part engineer, chemist, and biologist, and adapt rapidly as changes take place.

The nature of the problems are also rapidly changing. Early plant problems centered around floating and emergent species such as water hyacinth and alligatorweed, but submerged plants, such as Eurasian watermilfoil and hydrilla, are posing greater threats.

In summary, aquatic plant problems and control technology are rapidly changing, the future of aquatic plant management belongs to individuals who will do likewise.

Harry D. Niemczyk, Ph.D.

Dr. Niemczyk is Professor of Entomology for the Ohio Agricultural Research and Development Center in Wooster, a research facility of Ohio State University. He is also a consultant for Chem-Lawn Corp.

Niemczyk's research centers on insects of turf. Two examples of his research are the life cycle of the ataenius beetle and the characteristics of the winter grain mite. Both pests are not found on any registered pesticide label even though they can cause significant damage to turf. Niemczyk is working to collect information to make registration of pesticides for these minor pests more likely.

Niemczyk received his Ph.D. from Michigan State University. In 1974, he was presented with the Ohio Turfgrass Foundation Professional Excellence Award. He is a member of the Entomological Society of America, the American Society of Agronomy, the International Turfgrass Society, and the Ohio Turfgrass Foundation.

An ardent fisherman, Niemczyk often returns to Michigan with his wife and four children to fish for steelhead.

The single most significant event in turfgrass entomology was the labeling of DDT and later the chlorinated cyclodiene insecticides (aldrin, dieldrin, heptachlor, chlordane) for control of turf insects and, in the case of chlordane, crabgrass.

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These compounds were used successfully for many years. In fact, they were so successful that research on turf insects declined at universities and agricultural experiment stations. The importance of insects in turfgrass management courses also declined in turf schools.

Another significant event occurred in the early 1960's when an instrument known as the gas chromatograph (GLC) was developed. The GLC provided the capability of measuring pesticide residues in parts per million. This sophisticated instrument was to have a major impact on the use of all pesticides. With the GLC we soon learned that DDT and the chlorinated cyclodienes left unacceptable residues in the environment, including the food chain. Paradoxically, the major advantageous characteristic of these compounds, long residual activity, ultimately led to their demise.

The residual characteristics of these insecticides led to other problems. Among the more serious was the development of insect strains resistant to them.

With the removal of aldrin, dieldrin, and heptachlor from use in the early 1970's and, more recently, chlordane, the few remaining turf research entomologists recognized the need to conduct research designed to provide substitutes for these insecticides. Their efforts, together with those of the chemical industry, led to the labelling of the organophosphates, diazinon, chlorpyrifos (dursban®), and trichlorfon (Dylox®-Proxol®) for grubs and other insect pests. While these insecticides generally provide good control of chinchbug, sod webwrom and other pests that inhabit the turf surface and thatch, they frequently provide only fair control of grubs that inhabit the soil. We now know that among the factors limiting their effectiveness against soil pests is the fact that the insecticide can be bound to the thatch before it reaches the target pest. Another major factor is that consumers are unaccustomed to using short residual insecticides, and therefore do not properly follow required irrigation and other procedures to immediately move the insecticide to the target.

Loss of the chlorinated cyclodiene insecticides means shifting from the "spread it and forget it" philosophy long associated with these compounds, to one of "reach the target pest NOW" necessary with organophosphates. This causes many problems. For the consumer it places new emphasis on the need for safety. It also means more attention must be given to rates and uniform distribution of the product. Proper distribution of liquid insecticides requires higher volumes of water than are

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used for fungicides or herbicides, and few golf courses have equipment to apply granular insecticides properly. Applications must also be accurately timed because the long residual activity is not there to 'eventually' control the pest.

Now, more than ever before, the consumer must have knowledge of the target pest's life cycle. Many still do not understand why this is necessary when the objective is to kill the pest, not study it. The answer,of course, is that the life history points out when the insect is most vulnerable to control and therefore sets the time of application. Without that knowledge treatment timing is a guess.

The change in philosophy and need for new knowledge requires additional training. Unfortunately, extension entomology in most states is overburdened and does not have adequate personnel to provide the specific training turf managers and other consumers need. Frequently, the turf specialist, who is likely an agronomist or a horticulturist, finds himself called upon for such input. Since most of these specialists have had little or no formal training in entomology or insecticides and their use, the information communicated to the consumer can be inadequate and sometimes inaccurate. The need for extension entomologists and others with professional knowledge of turf insects and the principles of their control must be made known before the consumer's needs for information can be met properly.

The shift from long residual to short residual insecticides for control of insect pests of turf has clearly identified that more research is needed in turfgrass entomology. While most states have an agronomist or horticulturist doing research on the agronomic aspects of turf, there are about five turf research entomologists in the U.S. Little or no research has been done on control of recently "discovered" pests like the greenbug aphid and winter grain mite. With so few researchers it will be some time before information needed to form the basis for labelling controls for these pests can be developed. We must know more about such important matters as: (1) the duration of the residual effectiveness of insecticides currently in use; (2) the susceptibility or resistance of present turfgrass varieties and strains to insect injury; (3) the physical, chemical, and biological factors relating to the movement of insecticides through thatch; and (4) cross resistance characteristics of the southern chinchbug resistance to certain organophosphate insecticides . . . just to name a few.

In summary, the future requires more emphasis on research and extension in turfgrass entomology. Research must show how we can best use the insecticides and management practices we now have to accomplish control of turf pests. New compounds for turf insect control are simply not currently being developed, and prospects for the future look equally dim.

Virtually every segment of the turfgrass industry is in serious need of a basic foundation in the principles of dealing with today's insect problems. The state extension services and the industry must rise to meet this challenge by seeking people with professional expertise to communicate the needed information. If such people are not available, then let the need be known so we can begin training them **now.**

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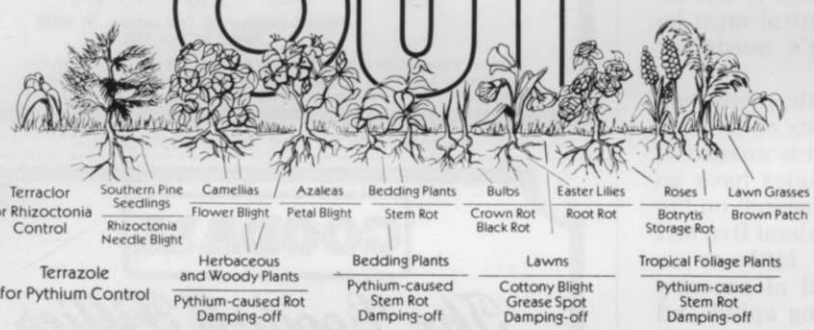

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HYDRAHAUL, an "all-in-one" utility vehicle now available from Ome, has an aluminum body and independent power source. The hydrostatic transmission changes from forward to reverse with a shift in foot pressure. It has no gears to shift, no clutches, and no belts to break, according to Ome. The all aluminim, hydraulic dump bed and fenders will never rust.

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TERSAN 1991, a product of E.I. Du Pont de Nemours, is now available in a water-soluble package. The convenient package goes into solution in minutes without any direct user-exposure to the fungicide from measuring and handling. Three ½ lb. soluble packets are packed into each 1.5 lb. bag. Quantities of the soluble packet will be limited this season, according to Du Pont. They recommend Tersan 1991 for the control of turf diseases, including dollar spot, large brown patch, Fusarium blight and stripe smut.

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MINIBRUTE is claimed to be the first

12-volt battery-powered chain saw by Tensen Company. Operation is simple, according to Tensen. The battery clips of the saw's power cable are attached to any 12-volt automotive battery and the saw is ready to go. Minibrute has an all-metal seven pound powerhead with a 20-ft. power cable and 14-in. sprocket nose bar. The power output is 985 watts. The saw only uses power when it is cutting. Tensen claims most automotive batteries have power enough to cut a pick up load of wood.

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VEGETATION MANAGEMENT

By Roger Funk, Ph.D., Davey Tree Expert Co., Kent, Ohio

Q: *What grass species have trouble growing in heavily shaded areas?*

A: None of the common turfgrasses are adapted to heavily shaded areas although some will tolerate more shade than others. In the northern states, the most common turfgrass with poor shade tolerance is Kentucky bluegrass *(Poa pratensis* L.), although a few improved cultivars will tolerate up to 65% shade. In the South, Bermudagrass *(Cynodon* L. C. Rich) displays the least shade tolerance. Conversely, the most common turfgrass species with good shade tolerance in the North is red fescue *(Festuca rubra* L.), and, in the South, is St. Augustine [*Stenotaphrum secondatum* [Walt.]Kuntze.

Q: *Is there any product other than Endothall for control of veronica?*

A: If you are concerned with the control of veronica in an established lawn, both Silvex and Trimec (2,4-D + MCPP + Dicamba) will give good control when the weeds are actively growing. Check the labels to see if either of these herbicides is recommended for your particular turfgrass.

Q: *I seem to have some difficulty obtaining good control with my webworm spray. By good, I mean lasting control. I have used Diazinon and Sevin, but in some cases, when I check a couple or three weeks later, new webs have appeared. Is there any other material that offers longer residual?*

A: There is no insecticide labeled for webworm control that gives longer residual than Sevin or Diazinon. However, you should not be observing new webs within three weeks of an application of either chemical. Perhaps you are applying too early, before all of the eggs have hatched. Also, be sure you have sufficient pressure to penetrate the webs with your spray.

Q: *When is the latest date to apply a crabgrass control?*

A: Crabgrass control is best achieved by pre-emergent herbicides that must be applied before the seeds germinate. The latest date is dictated by your climatic region and local weather conditions. Crabgrass seeds germinate when the temperature of the top one inch of soil stabilizes above 55° F. (about two weeks after soil first reaches 55° F.), which may vary as much as six weeks from one year to the next.

The spring flowering shrub, forsythia, is a fairly good indication of conditions for crabgrass germination. Your pregermination herbicide should be applied by the time forsythia bloom drop occurs.

One application should be sufficient unless you are in an area that also is plagued with silver crabgrass (goosegrass).

Q: *How much value to lawns and shrubbery are the expensive foliar nutrients? Is the cost worth any advantage?*

A: I would not pay a premium price for foliar fertilizers unless the plant was not responding to soil-applied fertilizers. Any soluble fertilizer can be used for foliar fertilization and the runoff can be absorbed by the root system. The real benefit of foliar fertilization is in providing nutrients to the plant when the roots have been injured or when soil conditions — primarily improper pH — prevents the availability and absorption of soil nutrients. This is particularly a problem with micronutrients such as iron, manganese and zinc in alkaline soils.

Q: *Please recommend trees that can be grown in extremely wet soils.*

A: Following is a list of trees which thrive in very wet soil:

Deciduous	
Acer dasycarpum	Silver Maple
negundo	Box Elder
rubrum	Red Maple
Alnus glutinosa	European Alder
Betula lutea	Yellow Birch
nigra	River Birch
populifolia	Gray Birch
Carpinus caroliniana	American Hornbeam
Carya ovata	Shagbark Hickory
Fraxinus caroliniana	Water Ash
lanceolata	Green Ash
Gleditsia aquatica	Waterlocust
Larix americana	American Larch
Liquidambar styraciflua	Sweetgum
Magnolia glauca	Sweet Bay Magnolia
Nyssa sylvatica	Sourgum, Tupelo
Platanus occidentalis	Buttonwood
Populus balsamifera	Carolina Cottonwood
grandidentata	Largetooth Aspen
Quercus bicolor	Swamp White Oak
palustris	Pin Oak
phellos	Willow Oak
Salix alba	White Willow
babylonica	Weeping Willow
fragilis	Brittle Willow
nigra	Black Willow
pentandra	Laurel Willow
vitellina	Golden Willow
Taxodium distichum	Bald Cypress
Tilia americana [glabra]	American Linden
Evergreen	
Abies balsamea	Balsam Fir
Chamaecyparis thyoides	White Cedar
Picea mariana	Black Spruce
rubra	Red Spruce
Thuja occidentalis	American Arborvitae
Tsuga canadensis	Hemlock

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PROSCAPE

By Michael Hurdzan, Ph.D., golf course architect and consultant

Q. *We plan to rebuild some tees — what should we consider? H.M., Bedford, In.*

A. You should consider: (1) the number of rounds of golf played each year, (2) where the building material will come from, (3) who will do the rebuilding, (4) the possibility of incurred liability if you change the tee angle or position, (5) the time of year, and (6) the turfgrass that will provide the tee surface. This list is by no means comprehensive, but it should answer most of your questions.

First, the number of rounds of golf you anticipate will be played each year will help determine the size of your new tees. (In the northern latitudes about 40,000 rounds a year is a very busy golf course whereas in more moderate climates it is not unusual to play two to three times that amount.) The rule of thumb is to allow 150 sq. ft. for every 1,000 rounds on a wood shot hole and 200 sq. ft. per 1,000 on an iron shot hole. This means on a course playing 40,000 rounds per year, the tee on wood shot holes should be 150 sq. ft. x 40 = 6,000 sq. ft. and 8,000 sq. ft. on an iron shot hole. Naturally this figure reaches a limit of practicality no matter how many rounds are played a year and it is a maximum of about 10,000 sq. ft. This figure refers to usable space with normal soil conditions, so that the injured turf can have time to heal itself.

Many superintendents either do not have the luxury of space to build such large tees, or do not wish to maintain such large areas during the healing process and prefer a tee surface that permits more intensive mangement to accelerate recovery. Thus, when building or rebuilding tees they have chosen to employ a U.S.G.A. type construction or a PURR-Wick system. Although much more expensive to build than a soil tee their performance is superior. Others who do not have the money to build such sophisticated systems have simply optioned to incorporate about 60 percent sand into the topsoil to increase the resistance to compaction, to improve internal air and water spaces, and to encourage deeper rooting and hence stronger turf plants.

It is normally recommended that a tee have a slight crown in the middle of about 6 in. on a 60 ft. wide tee to give some surface drainage.

The second consideration in rebuilding tees is where the building material comes from. [I am of course assuming that the tee will be elevated above the existing terrain to provide it with surface drainage, give the tee definition, and improve the visual presentation of the hole.) If the material is to be trucked in, there is the resulting damage from the trucks and the increased chance of differential settling resulting from the condition of the fill material (composition and consistency) not to mention the possibility of widely varying chemical or physical properties unless taken from the same source. If the material is available on the property, not only will its cost be less and its response be more predictable, but also it may allow for moving the fill during dry periods with less damage to the turf and as men and resources are available. Usually fill material will settle 15 percent of its depth but since this is so unpredictable it is suggested to place the fill in the proposed location in the dry season, assuming it does not adversely affect play patterns, and allow it to settle over the rainy season.

Who does the rebuilding of the tees will influence not only the cost but also the scope of the rebuilding. A professional golf course contractor is the best buy but funds may dictate that you must subcontract the work or do it yourself. A golf course contractor has the special equipment and operators to quickly and efficiently do any size job so that the turf is either sodded or planted with maximum establishment time and with the highest quality.

A book could be written about the assumed liability that a club takes on when ever they change the tee location or playing angle. Since safety to other golfers is paramount and neglect of safety leads to law suits, one must be careful about the proper siting of a tee. It is a well known fact that 80 percent of golfers slice the ball and the play emphasis is to the right. To neglect this fact and other such information and place a golf feature in unsafe position is a risk too great to ignore. If any change in play pattern may result from a tee relocation, it is strongly suggested that a competent golf course designer be retained for the project. A list of golf course designers is available from the American Society of Golf Course Architects, 221 N LaSalle Street, Chicago, Illinois 60601 or from The National Golf Foundation, 200 Castlewood Drive, North Palm Beach, Fla., 33408.

The time of year that the tees are to be rebuilt is a consideration, especially if the new tees will occupy the exact position of the old ones. Since few golfers want to play from poorly conditioned or temporary tees, new tees should have 6-8 weeks of good growing weather after seeding, sodding or sprigging to establish a strong, tightly knitted sward. Therefore in northern climates the ideal starting date is just after Labor Day and in bermuda grass areas it is early to mid May. Consider your manpower, normal maintenance, irrigation needs, and weather of these periods if you intend to rebuild them yourself.

Since 20 percent of golf shots are played from the tees (by the average golfer), with a turf damaging golf swing, it is reasonable that the tees should not only be as large as possible but also have the best turf quality. Therefore it is recommended that the very best cultivar or blend of cultivars be selected and used, for the cost increase will be small compared to the maintenance savings. All things being equal using the most aggressive varieties for wound healing is a very important consideration.

You asked me for the time and I told you how to build a watch, but rebuilding tees should be considered a major construction project. **WTT**

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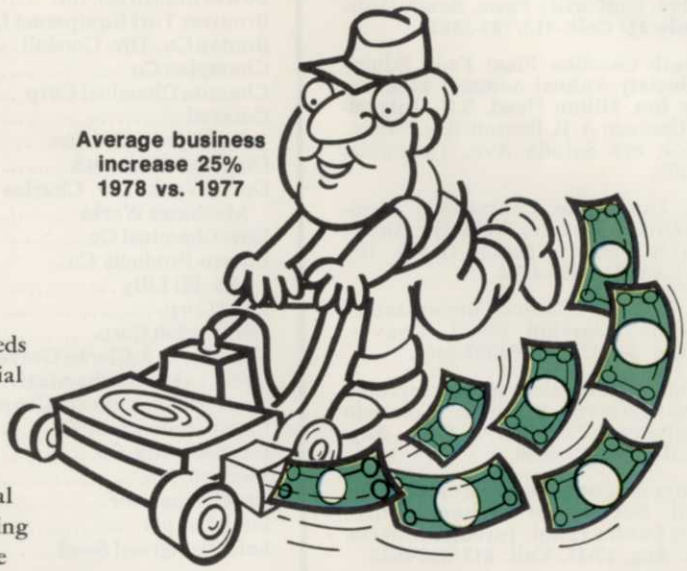

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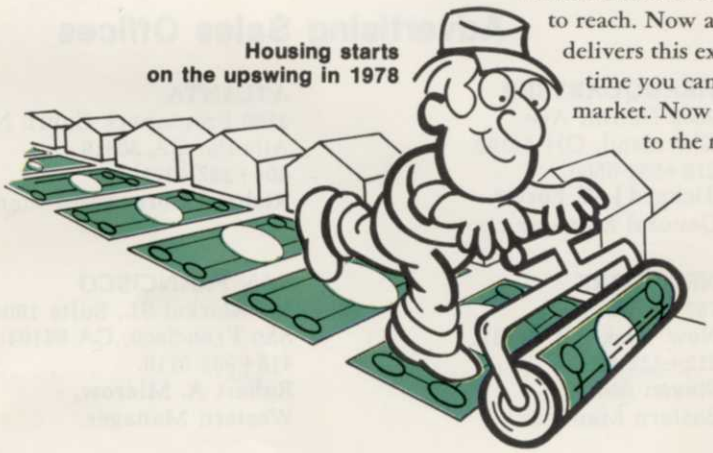

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103rd American Association of Nurserymen Convention, Fairmont Hotel, New Orleans, La. **July 15-19.** American Association of Nurserymen, Inc., 230 Southern Bldg., 15th and H Streets, NW, Washington, D.C. 20005. 202/737-4060.

American Sod Producers Association Summer Convention & Field Days, Sheraton-Spokane, Spokane, Wash., **July 19-21,** 402/463-5691.

Missouri Turf Field Day, University of Missouri South Farms, Columbia, Mo., **July 25.** Call: 314/882-7838.

1978 Penn Allied Nursery Trade Show, Hershey Motor Lodge and Convention Center, Hershey, Pa., **July 25-27.** Call: 717/243-1786.

University of Massachusetts Turfgrass Field Day, University Farm, South Deerfield, **July 26.** Call: 413/545-2353.

The South Carolina Plant Food Educational Society Annual Summer Meeting, Holiday Inn, Hilton Head, S.C., **July 30-Aug. 1,** Contact: A. B. Everett, Sec.-Treas., TSCPFES, 615 Saluda Ave., Columbia, S.C. 29205.

Illinois Landscape Contractors Association Annual Summer Field Day, Stonegate Farm Nursery, Poplar Grove, Ill., **Aug. 2.** Call: 312/894-4774.

ALCA Erosion Control/Revegetation Symposium, Marriott Hotel, Denver, Colo., **Aug. 3-4,** Call: 703/893-5400.

American Association of Nurserymen 1978 Management Seminar, Colorado State University, Fort Collins, Colo., **Aug. 13-18,** Call: 202/737-4060.

54th Annual Convention of the International Society of Arboriculture, Sheraton Centre Hotel, Toronto, Ontario, Canada, **Aug. 13-17.** Call: 217/328-2032.

Lawn, Garden, Outdoor Living Show, Division of National Hardware Show, McCormick Place, Chicago, Ill., **Aug. 14-17.** Call: 212/682-4802.

Tenth Biennial National Christmas Tree Convention, Amherst, Mass. **August 16-18.** Contact: National Christmas Tree Assoc., 611 E. Wells St., Milwaukee, Wisc. 53202.

Central Plains Turfgrass Association/Kansas State University Field Day, Kansas State University, Manhattan, Kan., **Aug. 23.** Call: 913/532-6170.

Farwest Nursery Garden and Supply Show, Memorial Coliseum, Portland, Ore., **Aug. 25-27.** Call: 503/221-1182.

Transworld Home Horticulture Exhibit, Chicago Expocenter, Chicago, Ill., **Sept. 10-13.** Call: 312/446-8434.

Turf and Landscape Day, Ohio Agricultural Development and Research Center, Wooster, Ohio, **Sept. 12.** Call: 216/264-1021.

International Pesticide Applicators Association Annual Convention, Sea-Tac Motor Inn, 18740 Pacific Highway South, Seattle, Wash., **Sept. 13-15.** Call: 206/362-9100.

Michigan Turfgrass Northern Field Day, Traverse City Country Club, Traverse City, Mich., **Sept. 13.** Contact: Paula M. Dietz, Dept. of Crop and Soil Sciences, Soil Science Building, Michigan State University, East Lansing, Mich., 48824.

Virginia Tech Turfgrass Field Days and Trade Show, Virginia Polytechnic Institute and State University, Blacksburg, Va., **Sept. 13-14.** Contact: John Shulders, Cooperative Extension Service, Va., Polytechnic Institute and State University, Blacksburg, Va., 24061.

Pacific Horticultural Trade Show, Anaheim Convention Center, Anaheim, Ca., **Sept. 20-22,** Call: 916/443-7373.

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